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A

HISTORY

OF

BRITISH FISHES.

BY

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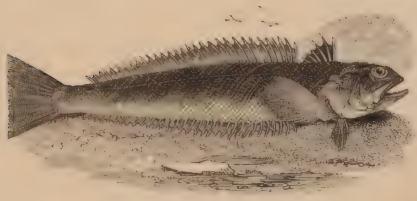
BRITISH FISHES.



THE GREAT WEEVER, STING BULL.

SEA CAT, *Sussex.*—FJÄRSING, OR FÄRSING, *Scandinavia.*

Trachinus draco, LINNÆUS. CUV. et VALENC. t. iii. p. 238.
Draco marinus major, viver Pieterman, SIBBALD, Scot. Ill. 24.
Trachinus major, Greater Weever, PENN. Brit. Zool. vol. iii. pl. 33.
" " " " DONOV. Brit. Fish. pl. 107.

URANOSCOPIDÆ. *Family Characters.*—Acanthopterygian fishes having the anus generally before the middle, and ventrals composed of a spine and five jointed rays, situated in front of the pectorals or under them, more rarely a little behind them. Dorsals commonly two, but the spinous or front one in some instances absent. Edges of the preorbitars and preopercula entire; sometimes a strong spine issues from the disk of the operculum, sometimes there is one from the shoulder. Mouth bordered wholly by the mandibles and premaxillaries, the maxillaries lying in the membrane behind the latter. Teeth on the jaws and vomer, and in some genera on the palatines. Branchial chamber large — branchiostegals six or seven, rarely only five. Stomach cæcal; pancreatic cæca from three to twelve. In many members of this family the ends of the rays of some of the fins are covered with thick sensitive skin.

TRACHINUS. *Generic Characters.*—Head large, subtetragonal, rounded laterally and beneath—mouth inclining upwards. Teeth small, numerous, acute on the jaws and palatines, the front of the vomer, the entopterygoids and pharyngeals. An opercular spine; the cranium more or less rough, and the suprascapular finely toothed. Spinous dorsal unconnected with the soft rays, ventrals jugular. Branchiostegals six: abdominal cavity short: no swim-bladder.

IN Müller's arrangement of fishes, which is mainly followed in the present edition of this work, the order *Acanthopteri* is characterized by an ossified internal skeleton, and dental scales of ctenoid structure, the instances of cycloid scales being few in number. With the exception of the caudal, the soft rays of the fins are generally preceded by one or more stiff spines without visible articulations. The ventrals are in most situated in advance of, or beneath the pectorals, and the swim-bladder has no air-duct. We commence with a family which has cycloid scales, and exhibits some other departures from the more general characteristics of the order.

Rondelet believed the fish now called the Great Weever to be the Draco of the ancient naturalists; and their references to the injuries effected by the spines of the dorsal fin and operculum of this species, which they also called a Sea-dragon, appear to confirm his opinion. The generic name *Trachinus* has been supposed to be derived from the Greek word signifying "rough," but Cuvier says that Artedi in using it simply Latinized the Italian names of the fish *trascina* or *trachina*, corruptions of *dracæna*, its appellation in modern Greek. It is called in Spain and Provence by terms that signify a spider, in reference to its supposed venom. The Scandinavian *färsing* has the same meaning.

The English name of Weever or Wiver, according to Merret, is considered to be derived from the French term for this fish, *La Vive;* a name bestowed upon it from the

circumstance of its living a long time after it has been taken out of the water; which latter power, with some other peculiarities in the habits of the Weevers, will be again adverted to. It is, however, probable that the Anglo-Saxon *wivere*, "a serpent," is the root of its modern English name. Whence also the Heraldic dragon or Wivern.

The Weever ranges southwards to the Canaries, where another member of the genus, the *T. radiatus*, also occurs. Mr. Lowe enumerates both the Greater and Lesser Weever among the Madeira fish, where the Portuguese name the former *Aranha do Mar*, and the latter simply *Aranha*. He did not find the *radiatus*. All three inhabit the Mediterranean Sea.

The Great Weever generally measures about twelve inches in length, but has been known to attain seventeen inches: its food is the fry of other fishes, and its flesh is excellent. It swims very near the bottom, is sometimes taken in deep water by the trawl-net, and occasionally with a baited hook attached to deep-sea lines. When caught, it should be handled with great caution. "I have known," says Mr. Couch, "three men to be wounded successively in the hand by the same fish, and the consequences have been in a few minutes felt as high as the shoulder. Smart friction with oil soon restores the part to health;" but such is the degree of danger, or apprehension of it rather, arising from wounds inflicted by the spines of the Weevers, that our own fishermen almost invariably cut off the first dorsal fin, and both opercular spines, before they bring them on shore: the French have a police regulation by which their fishermen are directed to cut off the spines before they expose the fish for sale; and in Spain there is a positive law by which fishermen incur a penalty if they bring to market any

fish without removing spines that are capable of inflicting a bad wound.

Mr. Peach says, friction with oil and laudanum gives almost instant ease.

That the Great Weever prefers deep water, that it lives constantly near the bottom, that it is tenacious of life when caught, and that its flesh is excellent, are four points that have been already noticed; but we may here say a few words with respect to tenacity of life in fishes generally. It may be considered as a law, that fish which swim near the surface of the water have a high standard of respiration, a low degree of muscular irritability, great necessity for oxygen, die almost immediately when taken out of the water, and have flesh prone to rapid decomposition. On the contrary, fish that live near the bottom of the water have a low standard of respiration, a high degree of muscular irritability, require less oxygen; sustain life long out of the water, and their flesh remains good for several days. The Carp, the Tench, the various Flounders, and the Eel, are seen gaping and writhing on the stalls of the fishmongers for hours in succession; but no one sees any symptom of motion in the Mackerel, the Salmon, the Trout, or the Herring, unless present at their capture. These four last named, and many others of the same habits, to be eaten in the greatest perfection, should be prepared for table the same day they are caught;* but the Turbot, delicate as it is, may be kept till the second day with advantage, and even longer, without injury; and fishmongers generally are well

* The Chub swims near the top of the water, and is caught with a fly, a moth, or a grasshopper, upon the surface; and Isaac Walton says, "But take this rule with you—that a Chub newly taken and newly dressed is so much better than a Chub of a day's keeping after he is dead, that I can compare him to nothing so fitly as to cherries newly gathered from a tree, and others that have been bruised and lain a day or two in water."

aware that fish from deep water have the muscle more dense in structure—in their language, more firm to the touch,—that they are of finer flavour, and will keep longer, than fish drawn from shallow water. The law referred to has its origin in the principles of organization; and though it would be difficult for the anatomist to demonstrate the differences in structure between the Trout and the Tench which give rise to these effects, it is only necessary to make the points of comparison wider to be assured of the fact.

Between a fish with a true bony skeleton having a high organization among fishes, and the Lamprey which ranks among the lowest, the differences are most obvious. If we for a moment consider the Lamprey, with a rudimentary vertebral column, as the supposed centre of zoological structure, and trace the scale of organization from thence upwards and downwards, we arrive at the extreme on one side at man, to whom division of this substance is destruction; but on the other, we descend to the polype, which, on being cut in pieces, gives rise to new individuals, each becoming equal to the animal of which they previously formed but a part.

To return to the Great Weever: the number of fin-rays are—

D. 6—30: P. 15: V. 1+5: A. 1+31: C. 14.

Head and body compressed;* teeth small and numerous; two small spines before each eye, irides golden-yellow; interoperculum and suboperculum smooth and without scales, cheeks and operculum with small scales; gill-opening large; vent under the last spine of the first dorsal fin; scales of the body arranged in oblique lines

* The compressed form of the body, somewhat like a sword-blade, has given rise to its German name of *Schwertfisch*, "sword-fish," equivalent to the French *poignastre*, by which it was known in Belon's time.

descending from above backwards; colour of the body reddish grey, browner on the back, paler on the belly, marked with dark and dull yellow lines in the same oblique direction as the scales; head brown with darker brown spots, and the gill-covers striped with yellow; membrane of the first dorsal fin black to the fourth spine, the remainder and the second dorsal fin pale brown, almost white; other fins light brown. Vertebræ forty, ten of them abdominal. The cavity of the abdomen, instead of terminating as usual before the anal fin, runs backwards over it. The spawning season is in June.

The following lines, referring to various qualities in the Weever, may be quoted by way of conclusion:—

> "The Weever, which although his prickles venom be,
> By fishers cut away, which buyers seldom see;
> Yet for the fish he bears, 'tis not accounted bad."
>
> DRAYTON, *Poly-olbion*, Song XXV.

A DUTCH FISHING-BOAT.

THE LESSER WEEVER, BLACK-FIN, STING-FISH.

ADDER (pronounced Otter and Etter*)-PIKE.—
STANGSTER AND STANG, *Scotland.*

Trachinus vipera, CUV. et VALENC. Poiss. t. iii. p. 254.
,, *draco*, *Common Weever*, PENN. Brit. Zool. vol. iii. p. 226, pl. 32.
,, ,, DONOV. Brit. Fish. pl. 23.

THE LESSER WEEVER is more frequently met with on different parts of our coast than the Greater Weever, and is especially plentiful on the sandy flats of Norfolk and Lincolnshire; it occurs in the bays of Dublin and Belfast, and is common on all the sandy

* ETTER or ATTER signifies poison.—Halliwell, who quotes

"Of vych a werm that *atter* bereth,
Other it stingeth, other it tereth."

ATTERCOP, a spider. Idem.

"An *ettercap* like him to blaw the coal."—*Ramsay.*

Sibbald mentions an *Etterpyle* and a Sea-Adder in his list of Scottish fishes.—*Scott. Illustr. App.* p. 37.

shores of Scotland; and being much smaller and quicker in its motions, is even more difficult to handle with security. In its habits it is active and subtle, burying itself in the loose soil at the bottom of the water, the head only being exposed; it thus waits for its prey—aquatic insects, or minute crustaceous animals—which the ascending position of its mouth enables it to seize with certainty. If trod upon or only touched while thus on the watch, it strikes with force either upwards or sideways; and Pennant states, that he had seen it direct its blows with as much judgment as a fighting-cock. Montagu says, "It appears that the wounds inflicted by these offensive weapons usually exhibit symptoms of great inflammation and pain, and which has given rise to the vulgar name of Sting-fish." It is often taken by the shrimpers, and thrown away as useless. This small species appears to have been much less perfectly known than the Greater Weever: neither Bloch nor Lacépède make any mention of it, and other writers have included in their description of a single species some of the peculiarities of both. Pennant, in the octavo edition of his British Zoology, dated 1776, says this small one "grows to the length of twelve inches;" and this statement appears to have misled Dr. Turton, Mr. Donovan, and Dr. Fleming, who have each assigned to it a length of ten or twelve inches. From the examination of many specimens, it is more probable that it very seldom exceeds five inches.

D. 5 or 6 — 24: P. 15: V. 1 + 5: A. 1 — 24: C. 11.

Cheeks devoid of scales; mouth ascending, and nearly vertical; teeth stronger in proportion to its size, but less numerous than in the larger species; and the obliquity of the lines on the side is less apparent. The back is

reddish grey; the lower part of the sides and the belly silvery white; the membrane of the first dorsal fin is black; that of the caudal tipped with black, and the other fins are pale brown. The Lesser Weever spawns in spring, the Greater Weever spawns in summer: neither species possess any swimming-bladder.

AN ENGLISH FISHING-SMACK.

THE RED GURNARD, CUCKOO GURNARD.

SOLDIER, RED ELLICK.—GAVERICK, *Cornwall.*

Trigla cuculus, Linnæus. Cuv. et Valenc. t. iv. p. 26.
„ *pini*, Bloch, pt. xi. pl. 355.
„ *lineata*, Montagu, Mem. Wern. Soc. vol. ii. pt. ii. p. 460.

Sclerogenidæ. *Family Characters.*—The second suborbitar scale-bone, prolonged across the cheek, and articulated to the hollow of the preoperculum, so as to afford a fulcrum to the spine which issues from the angle of that bone.

Trigla. *Generic Characters.*—Body rounded, scaly. Head short, subtetragonal; second suborbitar greatly expanded, joined by suture to the preoperculum and moving with it. Snout formed by the union of the prefrontals, turbinals, and point of the nasal, a salient angle of the pre-orbitar projecting before them. Gill-covers and humeral chain more or less armed. Branchiostegals seven; tubercular branchial rakers; no lingual bone. Villiform teeth on the jaws and pharyngeals; palate and tongue edentate. Lateral line straight to the caudal on which it forks. Dorsals two; pectorals large, with three inferior, free, finger-like rays. Stomach cœcal; pancreatic cœca eight to twelve; swim-bladder lobed anteriorly.

This family group was defined by Cuvier, who gave it the appellation of *Joues Cuirassées*, but having neglected to bestow on it a Latin designation, his French phrase has been translated variously by other ichthyologists, such as *Armigeræ* by Latreille, *Loricati* by Jenyns, and *Sclero-*

parei by Troschel. The peculiar character of the group is the articulation of the second suborbitar scale-bone with the preoperculum, giving firmness to the latter when the fish strikes its spine into an assailant. In some genera the second suborbitar is expanded so as to case over the cheek, in others it merely sends a narrow, smooth, or spiniferous process across the cheek to the angle of the preoperculum. Free and finger-like rays, detached from the pectoral, exist in several genera, and in the majority part or the whole of the rays of the pectoral, anal, and dorsal, though connected by membrane, have projecting tips which are either simple, or if divided are so enveloped by thick skin as to seem simple, a form of structure which is evidently subservient to the sense of touch, and is possessed by many ground fishes. This character is expressed by Dumeril in the family name of *Dactyles*, for which Rafinesque employs *Dactipli* and Dr. Gray *Dactilophori*. Müller, looking specially to the armature of the head, which is a conspicuous feature of numerous members of the family, names the group *Cataphracti*, "armed every way." The term here adopted is the one used by Professor Owen.

Of the first genus of this family, *Trigla*, the Gurnards, the British coast produces nine species, three of which are common, the others of rarer occurrence. They are chiefly caught by the trawl-net used in deep water, as the Gurnards swim near the bottom; and, in accordance with a remark made a few pages back, are tenacious of life after they have been taken from the sea. Excellent amusement is occasionally to be obtained by fishing for them with hand lines, the hooks baited with a shining silvery piece of a Sand-Launce.

The Red Gurnard inhabits the Mediterranean as far south as Malta, and the Atlantic as low as Madeira on

the east, and New York on the west. Its northern range is at least as high as the Orkneys,* and the Dutch coasts, but it has not as yet been detected in the Scandinavian waters. It is called, according to the Rev. R. T. Lowe, *Cabra* and *Ruivo* at Madeira. On the English coast it is very common, and in Ireland it is taken from Waterford on the south, up the eastern shore to Londonderry in the north, but is seldom found larger than twelve or fourteen inches in length. It feeds on crustaceous animals, spawns in May or June, and I have found the specific characters well marked in young Gurnards only an inch and a half long, taken in the small pools among the rocks under Portland Island, near the end of August. The flesh of the Gurnard is good food, and is in greatest perfection from October, throughout the winter months. The number of fin-rays is as follows:—

D. 9—18: P. 10—3: V. 1+6: A. 16: C. 11.

Few fishes have the head so well defended as the Gurnard: its form is nearly square; in the Red Gurnard, there are short, tooth-like processes on each side of the snout; the mouth is small, and is furnished with a band of small teeth on each jaw, and a small row on the vomer; the cheeks are hard, the gill-openings large; one small opercular spine is directed backwards, and a much larger scapular one projects above the pectoral fin; three free rays, which spread like fingers from beneath this fin, are abundantly supplied with nerves, and assist the fish as organs of touch to find its food at the bottom; the eyes are large, and the orbits are armed above with two or three small spines; both dorsal fins stand in a groove between two rows of short triangular spines directed backwards:

* Dr. Baikie, in his list of the Fishes of Orkney and Zetland, mentions that two specimens of *Trigla cuculus* were caught in Orkney in the winter of 1850-1.

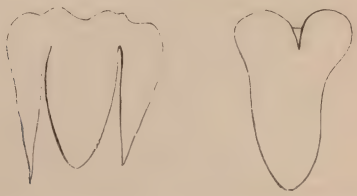
the body is covered with small oval, ciliated, roughish scales; between the rows of scales there are folds of skin, running up and down the sides, at right angles to the lateral line, and parallel to each other, which are discernible only as long as the fish is quite fresh; the lateral line is not armed, runs parallel to the line of the back of the fish, and is crossed throughout its length with small, short, straight, elevated lines, which have the appearance of a series of pins. Bloch compared them to the acicular leaves of the pine, a resemblance which suggested to him the trivial name of *pini* for this species. On the caudal fin the lateral line forks, one branch vanishing on the upper lobe of the fin, the other one on the lower lobe. The colour of the body of this fish, when quite fresh, is a beautiful bright red, the sides and belly silvery white; the first ray of the anterior dorsal fin is slightly crenated; the colour of the fins is reddish white, becoming paler the second or third day after the fish has been caught.

As the Gurnards are remarkable for the various forms of the swimming-bladders in the different species, an account of the structure, functions, and peculiarities of this singular organ, is here annexed.

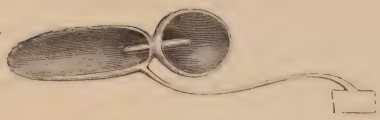
Rondelet was the first to notice that the swimming or air-bladder was more constantly found in fresh-water fishes than in those of the sea; and Needham and Redi soon after pointed out the diversity of form in the swimming-bladder that prevailed in different species. Redi afterwards described the duct or tube by which in many fishes this air-vessel communicates with the alimentary canal, and valuable additions to our knowledge on this subject have since been made by Monro, Lacépède, St. Hilaire, Cuvier, Müller, Owen, and Milne Edwards.

The swimming-bladder, as before stated, varies consider-

ably in form in different species. In the Sapphirine Gurnard it is composed of three lobes, placed side by side, as



shown in the annexed outline; in other Gurnards it is bilobate, but not very deeply cleft at the anterior part, as in the common Red Gurnard, the subject of the present notice, and the Grey Gurnard. In the Salmon, the Herring, and the Eel tribes, it is one elongated cylindrical tube, lying close to the under surface of the backbone. In the *Sciæna aquila*, the edges of the single-chambered swimming-bladder are fringed all round, of which a representation will be hereafter given; but in the Carp, as we have already mentioned, this organ is formed of two oblong cavities, the larger one lying behind the other, and communicating with each other by a tubular neck which connects the two parts. From the anterior end of the posterior chamber in the Carp, (a section of the whole subject, reduced in size from Monro's Anatomy of Fishes, is here added, with a probe introduced through the neck,) a tube runs forwards into the œsophagus, but is closed against the admission of any extraneous bodies by a delicate valve, which can only be passed in the outward direction. Some of the Cyprinoids have three-chambered air-bladders, and in that family, as well as in some others, the anterior division is connected by a chain of ossicles with the acoustic organ.



The air-bladder has usually two coats; of which the inner one has a moist, smooth, and, apparently, a secreting surface, and often contains one or more vascular and glandular bodies; the outer membrane is fibrous in its structure, and in some species the bladder is partially invested by a fold of the peritoneum: the three coats, when present, are nourished by blood-vessels, which are very conspicuous.

The air-bladder does not exist in all fishes: and it is absent in those especially that live near the bottom of the water. It does not exist in the *Dermopteri* or *Pleuronectidæ*, treated of in the first volume, nor in the extensive order of *Plagiostomi* that will be described in the latter part of this volume. Among the species that have an air-bladder, many have no canal or tube by which the air can escape from the bladder. Such are the fishes of the order *Acanthopteri*. Muscles for compressing the air-bladder are obvious in some species, and wanting in others, yet the air-bladder apparently performs the same service in all.

The gas contained in these air-bladders has also been the subject of repeated investigations. Priestly and Fourcroy determined the gas in the Carp to be nearly pure nitrogen; other chemists found the air in different fishes to consist of nitrogen, oxygen, and carbonic acid; the nitrogen in greater proportion, and the oxygen in smaller, than in atmospheric air. In the air-bladder of

marine fishes the oxygen is in excess, varying from forty to eighty-seven per cent., depending on the depth at which the different species usually remain. The Gurnards were frequently selected for these experiments, because their air-bladders having no canal of communication admitted of being removed without losing their contents. It should be borne in mind that fresh water contains more oxygen than that of the sea. Biot found as much as eighty-seven per cent. of oxygen in the air-bladder of deep-sea Mediterranean fishes. Professor Owen states generally, that in the air-bladders of sea-fishes living at great depths, oxygen predominates; but that in most fresh-water fishes the air-bladder is filled with nitrogen mixed with a very small quantity of oxygen and a trace of carbonic acid. Humboldt detected four per cent. of oxygen to ninety-six of nitrogen in the air-bladder of a Gymnotus; and Dr. Davy, in the air-bladder of a fresh-river Salmon, found a trace of carbonic acid, ten per cent. of oxygen, the remainder of the air being nitrogen.

The air thus found in these bladders, however variable in its nature, is believed to be secreted by the inner lining membrane, and in some instances by a red body, which appears to form part of the walls of the air-bladder itself, and is made up of minute blood-vessels arranged between the membranes. This structure in the Conger Eel will amply repay the trouble of examination.

That the air found in this bladder is not taken in at the mouth, is proved not only by the perfection of the valves of the canal, which only open outwards, but also by the want of uniformity in the quality of the air itself, and its existence in those swimming-bladders that have no canal of communication. That one use of these air-bladders to the fishes possessing them is to enable them to alter their specific gravity with reference to that of the

fluid they inhabit, seems almost certain. We see the Gold-fishes in our ornamental vases ascend and descend in the water without making any visible external muscular effort. In this respect their action is to be understood and explained by the well-known hydrostatic toy of the philosophical instrument makers, in which a small glass-balloon, or other figure, confined in a column of water has its weight, by the introduction of a small quantity of air, so nicely balanced in reference to the specific gravity of the water, that it is made to ascend or descend according to the degree of pressure made by the finger on the elastic cover of the top.

In other respects, however, the function of the air-bladder is quite as anomalous and uncertain as the quality of its contained gas. Our two Red Mullets have no swim-bladder, yet they appear in the water to possess all the powers of the Indian or American species, which are well provided with them. The two British species of Mackerel, hereafter to be described, both swim near the surface of the water with the same apparent swiftness and ease: one has a swim-bladder, the other none. Of our two species of *Orthragoriscus*, which, as far as the habits of such fishes are known, appear to possess the same powers, one has a swim-bladder, the other has none.

"The swimming-bladder of fishes," says Dr. Roget in his excellent Bridgewater Treatise, "is regarded by many of the German naturalists as having some relations with the respiratory function, and as being the rudiment of the pulmonary cavity of land animals; the passage of communication with the œsophagus being conceived to represent the trachea."

Harvey long ago observed "that the air in birds passed into cells beyond the substance of the lungs; thus show-

ing a resemblance to the cellular lungs in Reptiles, and the air-bladder in fishes." M. Agassiz, in dissecting a species of *Lepisosteus*, a Ganoid, fresh-water fish of America, found the air-bladder to be composed of several cells, with a tube proceeding upwards into the pharynx, and ending in an elongated slit, having everted edges, resembling a glottis or tracheal aperture. Various Siluroids and Protopteri possess air-bladders with similar pulmoniform complications, and though it is generally admitted that the chief function of the air-bladder is to regulate the specific gravity of the fish, yet, comparative anatomists consider it to be the homologue of the lungs of air-breathing vertebrals, or the rudimentary state in which that organ first appears in the ascending scale of the animal creation. Its connection with the acoustic organ, in some fishes, first described by Weber, has been alluded to in an account of *Cyprinus* and *Silurus*, (vol. i., pp. 356, 458), and the experiments of M. Valenciennes on the air-bladders of Gudgeons have also been mentioned in the first volume (p. 385).

The trivial names of *Cuculus* and Cuckoo Gurnard are said to have been given to this species on account of the similarity in the sound which issues from this fish when taken out of the water to the note of the well-known bird.

PORTITOR ILLE CHARON.

THE STREAKED GURNARD.

FRENCH GURNARD AND ROCK GURNARD.

Trigla lineata, Linnæus. Cuv. et Valenc. t. iv. p. 34.
,, ,, Bloch, pt. x. pl. 354.
,, ,, *Streaked Gurnard*, Penn. Brit. Zool. vol. iii. p. 377, pl. 66.
,, ,, ,, ,, Donov. Brit. Fish, pl. iv.
,, *Adriatica*, Gmelin. Flem. Brit. An. p. 215.
Grondin têtard, Duhamel, Sect. v. pl. 8, f. 5.

The Streaked Gurnard is the second of the British Gurnards that have large pectoral fins reaching beyond the vent, several of which have here been placed in succession, the more readily to distinguish them from those thereafter to be described, which have short pectoral fins. It is the second also of the species called by French ichthyologists *Trigles a corps cerclé* on account of the girdle-like distribution of the rows of scales on the body, technically named *squamæ verticillatæ;* and its steep straight face has obtained for it the appellation of *Rouget camard* in France.

In this Gurnard the head is much shorter, the profile more vertical, the spines of the head short, and on the

body transverse lines reach from the dorsal ridge down the sides to the belly.

The Streaked Gurnard seldom exceeds twelve or thirteen inches in length, and was first described by Brunnich under the name of *Adriatica*. It is found at the Canaries, where it is named *Rubio*, in the Mediterranean, on our southern, and occasionally on our eastern, coast, but in the last two places not in great numbers. It occurs also, according to Thompson, on several parts of the Irish coast, and occasionally on the west of Scotland. Like the Gurnards generally, this species feeds principally on crustaceous animals, and is usually taken with the trawling-net. The formula of the fin-rays is as follows:—

D. 10—16: P. 10—3: V. 1+5: A. 13: C. 11.

The head and snout are short; the occipital, opercular, and humeral spines short and broad; the eye is rather small compared with that of other species, and the irides yellow, with dark-blue pupils; the orbital spines are two or three; the scales forming the lateral line are elevated, carinated, and notched; and the body is encircled by as many cutaneous streaks as there are scales on the lateral line, a row of ordinary, square, ciliated scales alternating with every streak; the general colour of the body and fins is a fine rich red; the fins are spotted, and sometimes edged with a darker colour; the belly is white; the long pectorals are tipped with blue, and marked with four rows of large darkish-blue spots, so arranged as to appear like continuous bands when the fins are closed. The swimming-bladder is a single oval chamber, with strong lateral muscles of contraction. The spinal column is composed of thirty-three vertebræ, thirteen of them being abdominal.

THE SAPPHIRINE GURNARD.

KNORRHAHN AND SEEHAHN, *Denmark and Holland.*

Trigla hirundo, LINNÆUS. BLOCH, pt. ii. pl. 60.
,, ,, CUV. et VALENC. Poiss. t. iv. p. 40.
,, ,, PENN. Brit. Zool. vol. iii. p. 376, pl. 68.
,, ,, DONOV. Brit. Fish. pl. 1.
,, *lævis*, MONTAGU, Mem. Wern. Soc. vol. ii. pt. 2, p. 455.
,, ,, FLEM. Brit. An. p. 214, sp. 148.
,, *hirundo*, JENYNS, Brit. Vert. p. 340.

THE large size of the pectoral fins, and their fine blue colour on the inner surface, probably suggested both the English and Latin specific names of this Gurnard, which is moreover the most valuable of the British species. In addition to its being equal to the others as food, it is much more abundant, and attains a larger size, reaching two feet in length. That this species is the *Trigla lævis* of Montagu there can be but little doubt; though the words of Linnæus, "*linea laterali aculeata*," which are certainly incorrect, have led Pennant, Donovan, and Fleming into error, and induced Montagu to consider his *Trigla lævis* as distinct. The lateral line is undoubtedly smooth, whatever may be the direction in

which the finger is passed over it, and on this account the fishermen distinguish this species as the Smoothside.

The Sapphirine is common round our coast generally, but particularly from West Bay to the Land's End, where the Gurnards are called Tubs, Tubfish, and in reference to colour, Red Tubs; and it is called Tubs also at Youghal in Ireland, as mentioned by Thompson, who says it is found on several parts of the Irish coast. Like the other species, the Sapphirine Gurnard is taken by the trawl-net chiefly, but many are also caught on the long lines called bulters, with baited hooks. It spawns, according to Mr. Couch, in winter.* The flesh is of good flavour, though rather dry, and requiring sauce. In the north of Europe the flesh is salted for keeping. The specific identity of the Mediterranean *Gallina* or *Capone* with *Trigla hirundo* is not fully established.

D. 9—16: P. 11—3: 1+5: A. 15: C. 11.

This species bears some general resemblance to the Red Gurnard in form, but the head is larger and more flattened; the eyes large, the irides yellow, and the pupil dark greenish blue; the prevailing colour of the head and body is brownish red; the pectoral fins are large and long, reaching beyond the vent, are blue on the inner surface, and brownish red outside, with white rays; the spines of the operculum and scapula are similar to those of the Red Gurnard, but the rays of the first dorsal fin are not so strong as in that species. The scales are small, oval, and smooth; those on the lateral line are slightly elevated, but perfectly smooth, and the line bifurcates on the tail-fin. The air-bladder, as shown by the outline at

* Mr. R. Q. Couch remarks that as a general rule the Gurnards spawn during the latter part of winter, but that some are caught in spawn about July and August.—*Zoologist*, p. 1403.

page 14, vol. ii., has three lobes with strong lateral contracting muscles.

The lobed air-bladders would seem to be connected with the power of emitting sounds by certain fishes, since it is chiefly those which have complicated swim-bladders that have been remarked for the noises they make when taken out of the water, or even when swimming in it. The crowing, or grunting of the Gurnards, has obtained for them the names of Sea-cocks or Sea-hens in several languages. As to the word Gurnard, Cuvier seems to connect it with the French "*Grondin*, otherwise *Gurnaud* or *Gurnard*;" but it may perhaps have originated in the roughness of the head, *guurheid* in Dutch signifying roughness.

The Sapphirine Gurnard has thirty-four vertebræ, of which fourteen are abdominal, and the bodies of the last three of the latter are flattened beneath.

The vignette represents the cranium of this species.

THE LITTLE GURNARD.

Trigla pœciloptera, *Le Petit Perlon*, Cuv. et Valenc. t. iv. p. 47.
" " *The Little Gurnard*, Thomp. Proc. Zool. Soc. 1837, p. 61.
" " " " Idem. Nat. Hist. Irel. iv. p. 79.

Among some small fish taken in the summer of 1815 at Youghal in Ireland, and submitted by Mr. Ball to the examination of Mr. William Thompson, the latter gentleman found a Gurnard about two inches long, which on comparison with, was found to differ from, *Trigla cuculus*, *lineata*, *hirundo*, and *gurnardus*, but agreed in every character with the *Trigla pœciloptera* of Messrs. Cuvier and Valenciennes, as given in their work on the Natural History of Fishes, vol. iv. p. 47, quoted above, which fish had, at that time, been just discovered at Dieppe. M. Valenciennes, at my request, very kindly sent me a beautiful coloured drawing of this species, and on comparing it with the small specimen from Youghal which had been entrusted to me, I was also induced to

consider them specifically identical, and have accordingly given the species a place among British Fishes.

M. Valenciennes was the discoverer, on the sandy shores of Dieppe, of this little Gurnard, which is distinguished from others by numerous small milk-white spots on the dark-coloured inner surface of the pectoral fins. It is usually found in the small pools of sea-water left on the sands by the retiring tide; and is also taken in quantity by the shrimpers when working their small nets in three or four feet of water. These shrimping fishermen, who are well acquainted with the Gurnards, agree in opinion that this little species seldom exceeds four inches in length.

The head is of a uniform pale red; the back is reddish brown, becoming grey when the specimen is preserved in spirit of wine; the belly is silvery: at the origin of the ventral fins the surface inclines to red; the body and sides have a golden lustre, giving to this little fish a very brilliant appearance; both dorsal fins and the caudal are of a red colour, with darker shades of violet towards the edges of the connecting membrane. The pectoral fins are dark reddish brown, with, as before observed, several small milk-white spots on the darker part of the inner surface of the fin, next to the body of the fish.

The number of the fin-rays in this species are—

D. 9—17: P. 11—3: V. 1+5: A. 15: C. 12.

The wood-cut, which exhibits the character of the arming of the head and gill-covers and the spotting of the pectoral fin, &c., was copied from the drawing sent me by M. Valenciennes, as before referred to.*

* The Zoologist for 1857, p. 5608, contains an account of the capture of a young Gurnard not more than an inch in length, which was thought to be of this species.

THE PIPER.

SEEHAHN, *Holland.*

Trigla lyra, LINN. BLOCH, pl. 350. CUV. et VALENC. t. iv. p. 55.
" " *Piper*, PENN. Brit. Zool. vol. iii. p. 374, pl. 67.
" " " DONOV. Brit. Fish. pl. 118.
" " " FLEM. Brit. An. p. 215, sp. 154.
" " " JENYNS, Brit. Vert. p. 341.
Lyra, Crowner and Sea-hen, SIBBALD, Scot. Ill. p. 24.

THE PIPER is distinguished at once from the other species of British Gurnards, by the large size of the head, the greater extent of the nasal projections, and the length and strength of the opercular and scapulary spines; the arming of the dorsal crest is also more decided. This fish was described by Belon and figured by Rondelet, and is a species well known in the Mediterranean Sea. On our own coast it is rare; it was, however, obtained by Pennant, and since his time by Donovan and Mr. Couch. Pennant says the Piper is frequently taken; but this apparent contradiction to what is stated above, is explained by an observation made by Mr. Couch. "The Piper wanders about more than the others, at least, of the Cornish species; consequently it is sometimes common, and at others somewhat rare." It is chiefly obtained on the western shores of Devonshire and

Cornwall, occasionally off Anglesey, and according to Thompson it frequents the south and south-western coasts of Ireland. It attains the length of two feet, weighing then three and a half pounds, and is supposed to have gained the name of Piper from the sound which escapes from it when taken in hand from the sea. All the species, however, emit a grunting noise at intervals for a considerable time; which may probably have given origin to the name that distinguishes them coming by some corruption from the Latin *grunnio* or the French *gronder*.* Perhaps it is the enhancement of rarity, which causes its flesh to be considered superior to that of the other Gurnards; even Quin has borne testimony to the merits of a west-country Piper.

D. 9—16: P. 11—3: V. 1+5: A. 16: C. 11.

The head is large, but the body tapers rapidly to the tail; the eyes are large, the irides yellow, the pupils dark blue; there is one strong orbital spine in front, and a smaller one behind; the anterior lateral portions of the muzzle are much produced, and are notched, and the mandible is shorter than the snout; the gill-openings are large; and both opercular and scapular spines are large and strong. In a specimen, twenty inches long, the scapular spine measures two inches and a quarter; the pectoral fins reach beyond the vent; the armature of the ridges of the back is more conspicuous in this than in any other British species; the lateral line is slightly elevated above the general surface, and ascends gradually to the upper edge of the operculum: the scales of the body are small, oval, and ciliated, and the general colour is a brilliant red; the belly is white, the fins are red. Donovan's figure, otherwise very good, is much too pale in colour.

* See p. 23, where other etymologies are mooted.

THE GREY GURNARD.

KNOUD OR NOWD, *Ireland.*—CROONER, CROONYAL, AND GIRNAT, *Scotland.*—KNOT AND KNORRHANE, *Sweden.*

Trigla gurnardus, LINNÆUS. BLOCH, pt. ii. pl. 58.
,, ,, CUVIER et VALENC. Hist. Nat. des Poiss. t. iv. p. 62.
,, ,, *Grey Gurnard*, PENN. Brit. Zool. vol. iii. p. 371, pl. 65.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 30.
,, ,, ,, ,, FLEM. Brit. An. p. 215, sp. 152.
,, ,, ,, ,, JENYNS, Brit. Vert. p. 342.

THE GREY GURNARD is much more common than either the Piper or the Streaked Gurnard, and is easily distinguished by its shorter pectoral fins, and by its elongated and slender body, generally of a greenish-brown colour, spotted with white above the lateral line. This species was first described by Belon; there is also a good description of it in Willughby's *Historia Piscium*, and an excellent figure in Klein. The Grey Gurnard is taken along the line of our southern and eastern coasts

going northwards to the coast of Scotland, the Orkney Islands, the Baltic, and the west coast of Norway. In Ireland the Grey Gurnard occurs in all the localities which produce the Red Gurnard, *T. cuculus*;—namely, from Waterford in the south, up the eastern coast to Londonderry in the north. It ranges southwards along the Spanish peninsula and in the Mediterranean, frequents the coasts of France and Italy. This species spawns in May or June; its swimming-bladder in shape resembles that of the *Trigla cuculus* of Linnæus, but the fish is considered to be inferior. The fin formula is—

D. 8—20: P. 10—3: V. 1+5: A. 20: C. 11.

The head is less elevated than that of the other Gurnards, and the profile of the face is concave; the anterior prominences of the upper jaw are armed with two or three acute points; the eyes are large, the irides silvery white, the pupils black, and each orbit has one small spine on its edge; the opercular and humeral spines are slender and sharp: the body of the fish is long and attenuated, and the general colour is brownish grey or greenish grey, with a few irregularly-placed white spots on the back; the belly is silvery white; the lateral line is strongly serrated by a sharp crest of white scales; and the scales of the body are small, oval, and smooth: the first dorsal fin is brown, sometimes spotted with black; its three or four anterior rays are granulated, and rough to the touch: the second dorsal and the tail-fin are light brown: the pectoral fins are short, not reaching the vent, and are dusky grey, but liable to some variation of colour: the ventral and anal fins are nearly white. Occasional varieties in colour occur among the Gurnards, more especially observed in the common *cuculus* and *gurnardus* of Linnæus. The varieties of the latter are frequently red, resembling

cuculus, but are distinguished by the short pectoral fins, the three or four granulated spines of the first dorsal fin, and the long and slender body. The varieties of *cuculus* are mostly brown, resembling in this respect the general appearance of the Grey Gurnard, but differ in their long pectoral fins reaching beyond the vent, as well as in their shorter and thicker body. However variable the colour of the Gurnards may appear, the other specific characters remain unchanged, except that the young Grey Gurnard till it is seven or eight inches long has a black spot on the upper edge of the first dorsal fin, in this particular resembling the species next to be described; and further, that the sharp serrated scales forming the lateral line become smoother by age.

The northern provincial name, Crooner, says Dr. George Johnston of Berwick, "may have reference either to the hard and somewhat peculiarly-shaped head of this fish, from "croon," the top of the head; or it may be derived from the verb "croon,"—viz. to hum an air in an unmusical tone, because of the peculiar noise which the fish sometimes utters on being taken from the water." The groan or grunt uttered by the Gurnards having strongly attracted the attention of fishermen has given rise to the names bestowed on these fish in various languages. Thus this species is called in the Scandinavian peninsular *Knot*, signifying "murmur," evidently the source of the term Knoud of the north of Ireland. *Knorrhane*, or "grunting cock," is another Swedish name for the Grey Gurnard.

A writer in the Magazine of Zoology and Botany, says, "The Grey Gurnard is very abundant on the western coasts of Scotland, and often delights to swim on the surface. We recollect observing the sports of shoals of this species when on an excursion to the

Western Isles, during a week of beautiful, but too calm weather, for it was before steam-boats plied. They were often discoved by their noise, a dull croak or croon, whence most probably their provincial name of *Crooner*, or by the ripple or plough of their nose on the surface of the calm sea; thus they would swim for a few yards, and then languidly sink for a foot or eighteen inches, display and stretch their lovely fins, and again rise to the top. Boats were out with hand lines, almost all were half full, the men having little to do but bait the hooks and pull up. We resorted to our guns, and killed sufficient for dinner from the deck of the vessel."

FISHWOMAN AT SCHEVELING.

BLOCH'S GURNARD.

Trigla Blochii, YARRELL, Brit. Fish. 1st Ed.
,, *cuculus*, BLOCH, pt. ii. pl. 59.
,, ,, CUV. et VALENC. Poiss. t. iv. p. 67.
,, ,, *Red Gurnard*, PENN. Brit. Zool. vol. iii. p. 373, pl. 66.
,, ,, ,, ,, MONTAGU, Mem. Wern. Soc. vol. ii. p. 457.
,, ,, ,, ,, FLEM. Brit. An. p. 215, sp. 153.
,, ,, BLOCH. JENYNS, Brit. Vert. p. 343.

Two kinds of Red Gurnards having received the trivial name of *cuculus*, the first given by Linnæus, the second by Bloch, and both species being entitled to a place in this work, I have followed the practice usually adopted in such cases, and propose for the second the name of its describer, as a tribute due to the author of the most valuable work on Ichthyology at the time of its publication.

This second species of Red Gurnard, the *T. cuculus* of Bloch, not the *T. cuculus* of Linnæus,—and which, for the reason assigned, as well as for distinction, is here called Bloch's Gurnard,—is not common on some parts of our coast. Pennant, by whom it is shortly described, and who has added a figure, as quoted above, like Bloch, considered this fish to be the *T. cuculus* of Linnæus:

Klein, however, appears to have been of a different opinion; and Cuvier and M. Valenciennes have characterised it as a distinct species. Risso has also described it as distinct among his Fishes of the Mediterranean, under the name of *Granaou*, *T. cuculus*, and says the first spinous ray of the first dorsal fin is the longest; which is not the case in the common *T. cuculus*. Compared with the true *T. cuculus* of Linnæus, the first of the Gurnards described and figured in the present work, Bloch's Gurnard, will be found to have the body longer and narrower, the head smaller, but more powerfully armed, the pectoral fins short, not reaching to the anal fin, and the first dorsal fin marked with a conspicuous black spot on the margin of the membrane connecting the fourth, fifth, and sixth rays. The spot on the first dorsal fin, however, must not be considered as sufficient of itself to identify this species; as two specimens under comparison, both having this black spot, are in reality only varieties of the Grey Gurnard.

Montagu considered the Red Gurnard, described in the Memoirs of the Wernerian Society already quoted, to be distinct from the Grey Gurnard; but has certainly described the common Red Gurnard under the term *lineata*, employing that epithet as applicable to the series of linear elevations which cross the lateral line, and which induced Bloch to call the species *T. pini*. This character is shown in the woodcut of the Red Gurnard, but is scarcely perceptible, from the smallness of the scale, without the assistance of a lens.

Not possessing a specimen of Bloch's Gurnard, the description of it by Colonel Montagu is adopted. "The forehead is more sloping than that of the Grey Gurnard, and the nose is armed with three spines on each side; the spine on the operculum, and the one behind it, are

long and rough; the lateral line and ridge of the back on each side are serrated; a large black spot on the margin of the first dorsal fin extends from the third to the fifth ray. The whole body is rough: the spine on the gill-covers reaches nearly as far as the spine behind it; and the lateral line and ridges on the back are more strongly serrated than in the Grey Gurnard."—"Many of these," according to Colonel Montagu, "are taken in the summer months on the coast of Devon by the shore-nets; their size being inferior to the other Gurnards, rarely exceeding a foot in length, and seldom above nine or ten inches. Mr. Charles Barron, Curator of the Haslar Museum, states that he has obtained specimens of this fish three or four times in the Solent, the largest measuring five inches.

The fin-ray formula, as given by Cuvier, is as follows:—

D. 8—19: P. 11—8: V. 1+5: A. 17: C. 11.

This species occurs also in the Channel, at Boulogne, and, as before mentioned, in the Mediterranean. Cuvier and M. Valenciennes have described the internal anatomical distinctions, in the *Histoire des Poissons*.

Since the publication of the first edition of the British Fishes, Dr. Parnell, in his published prize essay on the Fishes of the Forth, and Mr. William Thompson, in his History of Ireland (iv. p. 75), have considered this Gurnard to be merely the young of the Grey Gurnard, and therefore not entitled to specific distinction. Their reasons for coming to this conclusion are also fully stated. It will be remembered that this Gurnard has been figured as a peculiar species, by Klein, Bloch, and Pennant; and has been described as distinct by Risso, and others. In the first part of a very recent publication on the Fishes of Denmark, by M. Henry Croyer, a distinguished

Danish naturalist lately returned from Spitzbergen, and now travelling in Lapland, our *Trigla Blochii* is mentioned as distinct from *T. gurnardus*. Baron Cuvier was perfectly aware of the changes which occur in the Grey Gurnard (*T. gurnardus*), from youth to age, and the following comparative statements from his account of the anatomy of the viscera of the *T. gurnardus* and of *T. cuculus* of Bloch, the *T. Blochii* of this work, seem to me to prove that Cuvier must have had two distinct species under examination.

GREY GURNARD.

Liver small, of three lobes, deeply divided, the left lobe terminating in an elongated point.

Stomach large, triangular, flattened above, parietes thin, seven cæcal appendages, four on the left side.

Spleen elongated, three-sided.

Swim-bladder large, in form like that of *T. pini*,—*i.e.* bilobed, and but slightly divided.

Vertebræ: fourteen abdominal, twenty-four caudal.

BLOCH'S GURNARD.

Liver larger than that of any other Gurnard, the left lobe divided, and forming several small lobules.

Stomach small, in form a scalene triangle, five cæcal appendages, three on the left side; very long and very large.

Spleen excessively small.

Swim-bladder very small, oval, very slightly divided anteriorly.

Vertebræ: thirteen abdominal, twenty-four caudal.

Having stated that the various species of Gurnards are chiefly obtained by a particular mode of fishing in the sea called trawling, and representations being introduced in the following pages of a trawl-net, and the

sort of fishing-boat most common on the Sussex and Hampshire coasts, it remains to describe both, and the mode of using them. The boat is about twenty-five feet long, and ten feet in the beam, or breadth. The average burthen about ten tons; and it carries three tons of ballast—generally shingle, with some loose pigs of iron, which are shifted from side to side as occasion may require. The boat is fitted with two masts, with a square sail to each; sometimes a third mast and sail are set up when the wind is very light, and when thus rigged it is called a lugsail-boat. The trawl-net for a boat of this power has a length of sixty or seventy feet, and is fitted to a beam of eighteen or twenty feet in length, being equal to the width of the mouth of the net. In the representation of this net, the rope on the extreme left

that runs through the block is the *trawl-warp*, and connects the boat and the net when the latter is overboard. The *bridle* passing obliquely from the block to the two sides serves to keep the mouth open and square to the front, when the net is drawn along over the ground. The *trawl-beam* is four inches diameter, and is supported at the height of twenty or twenty-four inches above the ground by a heavy frame of iron of a peculiar form at each end of the beam, called the *trawl-heads*, which assist by their weight to sink the net and keep it on the ground. The

upper edge of the netting is attached along the whole length of the beam; the lower edge is fastened along a heavy rope called the *ground-rope*, and follows considerably behind the advanced straight line of the beam, forming the portion of the circle seen through the upper surface of the net in the vignette. This sort of net is adapted for taking only fish that live upon, or very near the bottom. When drawn along, the first part of the net that touches the fish is the ground-rope, on which the fish darts upwards; but that part of the net hanging from the beam is not only over, but also in advance of him, while the onward draft of the net by the progress of the boat brings the fish against the closed end of the tail, and if he then shoots forward towards the mouth of the net, he is stopped and entangled in pockets that only open backwards. As the fish in a tideway lie with their heads against the stream, the fishermen trawl with the tide; that is, draw the net down the stream, carrying only so much sail on their boat as will give the net the proper draft along the ground—generally at the rate of two and a half or three miles an hour. When it is desirable to examine the contents of the net, the beam is hauled up to the side of the vessel by the trawl-warp, the tail of the net is handed in, untied, and the contents shaken out. The produce, depending somewhat on the nature of the ground, generally consists of Red Mullet, different species of Gurnards, Flat-fish, and Skate, with abundance of star-fishes, sea-eggs, and crustaceans. The saleable fish being selected, the tail of the netting is tied up, and the net again lowered to the ground; and while the vessel continues its course, the refuse of one haul of the net is swept overboard to make room for the produce of the next. On some parts of the Dorsetshire and Devonshire coast, the trawling-boats and their

apparatus are much larger than those here described; the former being cutter-rigged vessels of seventy or eighty tons burthen, and their nets of thirty-six feet beam. Such vessels are constantly employed trawling in West Bay, and in Torbay, and even as near London as Barking Creek, boats and nets of this size are common; but the fishing-grounds for these vessels and their crews are in various parts of the North Sea, where a large and stout boat is absolutely necessary. The principal trawling off the Sussex and Hampshire coast is in the Channel, from twelve to thirty miles from the shore, and the men are seldom absent more than one night at a time.

Where the water is deep, this mode of fishing is successfully practised either by day or by night; but if the water is shallow and clear, but little success is to be obtained in the day.

A HANTS LUGSAIL FISHING BOAT.

THE SHINING GURNARD,

OR LONG-FINNED CAPTAIN.

Trigla lucerna, L'Orgue, Cuv. et Valenc. iv. p. 72.
Cuculus, Rondelet, Latin edition, p. 287.
Rouget, ,, French ,, p. 227.
Trigla lucerna, Brigotte, Brunnich, Ichth. Massil. 1768, p. 76.
,, ,, *Orghe,* Risso, Ichth. p. 209.
,, *milvus,* ,, ,, Hist. p. 395.
,, *lucerna, Long-finned Captain,* Mag. Zool. and Bot. i. p. 526.

The Gurnard figured above was made known as a species new to the British Catalogue by Dr. Parnell, who obtained several specimens from the fishermen of Brixham in Devonshire, who do not consider it to be rare, and in reference to the elongation of the second ray of the first dorsal fin, call it the Long-finned Captain. The reason why a species so strongly marked as to specific distinction should have remained till lately unnoticed on our shores, will probably be found in the circumstance that this Gurnard does not generally exceed nine

inches in length, which not being considered by the fishermen a marketable size, the fish is not often brought on shore; yet its flesh is esteemed to be sweet and delicate.

The capture of several examples of this fish at Brixham, and the announcement of the circumstance in the first volume of the Magazine of Zoology and Botany, page 526, with a description and figure, has been followed by a communication from Mr. Baker, of Bridgewater, stating that the fish had occurred on that coast; a specimen is also stated in the Zoologist to have been taken at Tolpedn-penwith, near the Land's End, and it may be presumed to be plentiful as a species. Dr. Parnell saw seven taken at once in a trawl-net, and it is decidedly common in most parts of the Mediterranean. Brunnich, who described it in 1768, as quoted under the representation of the fish, found it at Marseilles. Savigny, according to M. Cuvier and Valenciennes, found it at Naples. Dr. Leach sent specimens to Paris from Malta. M. Risso includes it in both his volumes among the fishes taken in the environs of Nice, and mentions it as one known even to Aldrovandus, quoting lib. ii. cap. 58, page 279. Little appears to be known of the particular habits or food of this species; but it is supposed to spawn about June, from the large size of the roe in a female fish taken in that month. Dr. Parnell's specimens were obtained in the month of September.

I have followed M. Cuvier and Valenciennes in inserting references to the work of Rondelet, but with some doubt as to whether the fish there represented and described be not rather a different species of Gurnard. Our fish was probably called *lucerna*, from the brilliant and shining longitudinal silvery band which pervades the whole length of each side. I am indebted to Dr. Par-

nell for the specimen from which the following description was taken.

The whole length is nine inches and one quarter. From the point of the nose to the end of the occipital spine is to the whole length of the fish as one to four; and the depth of the head is to the whole length of the fish as one to six and a half; while the depth of the body is to the same length as one to six; the nose is rather short and blunt; at the superior anterior edge of each orbit there is a single short bony spine directed upwards; and at the inferior anterior edge of each orbit there is a groove directed downwards and forwards to the base of the external nasal bone, in which groove, about half way between the eye and the nose, the nostrils open; the exterior surface of the head is granulated and hard; the posterior margin of the skull on each side is furnished with two spines directed backwards, one of them arising from the edge of the operculum, the other from the occipital bone above it; and the humeral chain behind the operculum emits another spine, also directed backwards. The fin-ray formula is as follows:—

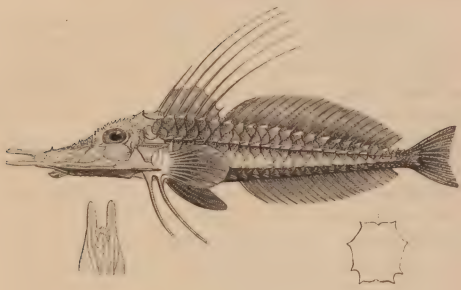
D. 9—18: P. 10—3: V. 6: A. 17: C. 14.

The first dorsal fin commences over the base of the pectoral fin, the second ray is more than as long again as the first ray, and the third ray is also a little longer than the first ray; afterwards the rays decrease in length gradually, the last ray being the shortest; the second dorsal fin commences over the anal aperture; its rays are nearly uniform in length throughout, the fin ending on the same plane with the anal fin, the rays of which commencing immediately behind the anal aperture, are also nearly uniform in length throughout; the tail-fin is lunate; the dorsal ridge contains from twenty-four to twenty-six plates, each

ending in a single point; the row of bony scales, on the lateral line, are in this species formed like wings, and are represented below the tail of the figure of the fish. The head and upper part of the body are of a fine vermilion colour; the irides silvery; along the side of the body there is a broad and shining silvery band, the belly below being reddish white: the pectoral fins are deep blue; all the others rosy red.

The characters of this Gurnard are so well marked that it is not likely to be confounded with any other species.

PURFLEET ON THE THAMES.



THE MAILED GURNARD.

Peristedion malarmat, Cuv. et Valenc. iv. p. 101.
Malarmat, Belon, p. 209.
Cornutus, sive Lyra altera, Rondelet, Lat. edit. p. 299.
Forchato, Malarmat, ,, Fr. ,, p. 237.
Lyra altera, Willughby, p. 283, tab. S. 3.
Trigla cataphracta, Malarmat, Brunnich, p. 72.
Malarmat, Duhamel, t. iii. Sect. 5, p. 113, pl. 9, f. 2.
Trigla cataphracta, Le Malarmat, Bloch, pt. x. pl. 349.
Peristedion malarmat, Mailed Gurnard, Mag. Nat. Hist. vol. i. N. S. p. 17.
,, ,, ,, ,, R. Q. Couch, Zool. 2398.

Peristedion. *Generic Characters.*—Body elongated, tapering, octagonal, clothed in scaly armour forming spinous keels, preorbitar scale-bone projecting, producing with its fellow a bifurcated snout. Mouth beneath, toothless, as are also the vomer, palatines, and pharyngeals: upper lip bearded. Two free infra-pectoral rays. Pancreatic cæca seven. Air-bladder large, simple.

This singular-looking fish, made known as British by Dr. Edward Moore of Plymouth, in the Magazine of Natural History for 1837, conducted by Mr. Charlesworth, was caught on the fishing ground between Plymouth and the Eddystone in the autumn of 1836. In the Zoologist for 1849, the capture of a second specimen

at the entrance into Mounts Bay is recorded by R. Q. Couch, Esq. It was taken in February.

It will be observed by the synonymes quoted, that this fish has been known from the time of Belon, who published in 1553, and has given a figure from an engraving on wood, which is easily recognised. It is also figured and described in the work of Rondelet, who, from a resemblance which it bears to *Trigla lyra*, the systematic name of our English Piper Gurnard, British Fishes, vol. ii. p. 26, called this fish *Lyra altera*, and also *Forchato*, from its elongated and bifurcated snout. Brunnich, after Rondelet, called it *cataphracta*, in reference to the armour-like scales with which the body is defended. The term *Malarmat* applied to a fish so well armed, at least defensively, could only have been bestowed in joke by way of antiphrase, unless it was originally meant to imply, *Armé d'une cotte de maille* (mail armour). In the Balearic Isles it is called *armado*, signifying simply "mailed."

M. Risso, who has briefly described some of its habits, says, it frequents deep water over rocky ground, approaching the shallows only at the period of spawning. It swims with rapidity, occasionally breaking off portions of its projecting preorbitar scale-bones against the rocks. It is said to be solitary in its habits, and feeds upon such animals as the medusæ, the beröe, and the thinner-skinned crustaceans. It inhabits all the western parts of the Mediterranean, is rather common, and attains the length of two feet. The British specimen obtained by Dr. E. Moore was about eleven inches long, and that mentioned by Mr. Couch was half an inch longer. It is said to be rare in the Adriatic, but has been taken at Venice. Duhamel, in his *Traité des Pêches*, says, that this fish, though so rare on the coasts of the Channel as to be almost unknown, is common on the coasts of Spain and Provence,

where it is caught in deep water. It is fished for all the year; but as an article of food it is in the greatest estimation in Lent. As there is but little to eat upon this fish when it is small, those of the largest size are the most in request. Duhamel gives the following instructions for preparing it for the table:—If it is intended for stewing, it is necessary to soak it in warm water in order to get off the skin and scales, which is mostly easily effected by commencing the removal at the tail: if it is preferred to broil it, it is then only necessary to open the body of the fish, and put inside fresh butter, fine herbs, and seasoning to increase the flavour of the meat, which is white and delicate. When it is sufficiently cooked the scales come off easily.

Dr. Moore very obligingly sent his British specimen of this fish up to London that I might see it, and I found that it exactly resembled an example from the Mediterranean in my own collection, with which I compared it.

The preorbitar bones are much elongated, forming together a projecting and forked snout of two broad and flattened finely-serrated processes, which are each an inch in length, and parallel to each other, half an inch apart at the base, with, on the upper surface of the latter, one large, and two smaller mamillary protuberances. From the tip of the elongated preorbitar to the posterior point of the ridge on the cheek at the base of the pectoral fin, the length is three inches and a half in a fish of eleven inches. The nasal, orbital, and occipital ridges, are armed with numerous sharp tooth-like processes. The orbit of the eye is oval, its greatest length horizontal, the irides silvery; the jaws are semicircular in shape; the form of the opening of the mouth, which is without teeth, is also semicircular; the length of the head, from

the point of the nasal bone to the end of the suborbital ridge, is to the whole length of head, body, and tail together, as one to three.

The body is octagonal, covered with bony scales, or plates, laid over each other like a coat of mail; from the centres of the scales, forming, by their close linear succession, the eight angles of the body, projects a series of acute processes pointing backwards; the scales vary in number on the different angles from twenty-three to thirty.

The fin-ray formula is as follows:—

D. 7. 18: P. 10. 2: V. 1+5: A. 18: C. 11. Vert. 43.

The first dorsal fin has seven rays, and five or six of the rays end in elongated flexible filaments, as shown in the figure. It is supposed that the males only in this species have these long filaments, the rays in the females remaining short, and this may account for some differences that appear in the representations given by some of the authors herein referred to. Mr. Couch states that the filaments of his specimen were very short, but he does not mention its sex. The second dorsal fin usually contains eighteen or nineteen short rays. The pectoral fin is stated by Cuvier to contain twelve rays connected by membrane, but his figure in illustration exhibits but ten rays, and I find there are ten rays in the pectoral fin in the Mediterranean specimen before referred to; Dr. Moore's fish is described as possessing but eight rays, but Mr. Couch reckons ten in his and two free ones; they appear therefore liable to variation; the free rays common to the Gurnard are in this species limited to two; between the ventral fins is an elongated and flattened pelvic bone: the body ends at the tail in three short projecting spines on each side of the base of

the caudal rays; the form of the caudal is lunate. Dr. Moore says of his fish that "its colour, when fresh, was of a uniform scarlet, like the Red Gurnard, gradually softening to pale flesh colour towards the abdomen; the anal and dorsal fins were crimson; but the others pale and greyish." Mr. Couch describes his example as having a yellowish vermilion tint fading towards the abdomen into a light flesh-colour.

VIRGINIA WATER.

THE RIVER BULLHEAD, MILLER'S THUMB.

TOMMY LOGGE.

Cottus gobio, LINNÆUS. BLOCH, pt. ii. pl. 39.
,, ,, CUV. et VALENC. Poiss. t. iv. p. 145.
,, ,, *River Bullhead*, PENN. Brit. Zool. vol. iii. p. 291, pl. 43.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 80.
,, ,, ,, ,, FLEM. Brit. An. p. 216, sp. 157.
,, ,, ,, ,, JENYNS, Brit. Vert. p. 343.

COTTUS. *Generic Characters.*—Head roundish, rather depressed, without other armature than a short spine at the angle of the preoperculum, sometimes a more minute one lower down, and the anterior pungent point of the suboperculum: mouth small, not passing the front of the orbit; teeth on the jaws and front of the vomer, none on the palatines. Body sub-fusiform, scaleless, with a soft tubular lateral line. Dorsals two, contiguous, the anterior one lowest, with flexible inarticulate rays. Pectorals having unbranched lower rays, over the ventrals, the latter composed of one spine and three or four soft rays. Branchiostegals six, the membrane more adherent than in the *Acanthocotti*. No air-bladder. Pancreatic cæca few.

THE FRESH-WATER BULLHEADS differ in aspect from the marine species, which have until lately been included in the same generic group. Mr. Girard, in an elaborate paper published in the Smithsonian Contributions to Knowledge for 1851, separated the marine ones under

the appellation of *Acanthocottus*, at the same time describing twelve American species of the restricted genus *Cottus* and one Greenland species. Heckel and Kner figure four Austrian fresh-water *Cotti*, including one which they name *gobio*, but which differs in physiognomy from our English Miller's Thumb.

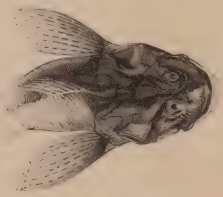
The accompanying representation of the skull of the River Bullhead shows the unarmed cranial bones, contrasting strongly with the many-spined skull of the *Acanthocotti*.

As only one European fresh-water Bullhead has up to a late date been recognised by ichthyologists, it has been made to comprehend many local varieties or species, and until specimens from different districts have been carefully compared with each other, the geographical range of the various kinds must remain undetermined. Artedi, whom Linnæus follows, quotes Willughby's figure (H. 3, f. 3) with commendation, the English fish may therefore be taken as the type to which the specific name of *gobio* should be henceforth appropriated; and as far as one can judge from figures and descriptions, it does not appear to differ materially from the *Sten-simpa* of the *Skandinaviens Fiskar*, with which Linnæus was undoubtedly familiar.

The River Bullhead is an inhabitant of almost all the streams of this country that flow over sand or gravel. It is equally common in all parts of Scotland, but it is so rare in Ireland that Mr. Thompson never met with an Irish specimen. It is mentioned, however, in a list of Derry fishes which he quotes. Its length seldom exceeds four or five inches, and it is generally found among loose stones, under which, from the peculiarly-flattened form of its head, it is enabled to thrust itself, and thus to find a hiding-place. When disturbed, it swims rapidly. The term Bullhead has originated in the size and bluffness of the head; and we use the words Bullfinch, Bullfrog, and Bulltrout, in the same sense.

The name of Miller's Thumb is said to have reference to the form of the head. The accompanying vignette will show that this is smooth, broad, and rounded, like the thumb of a miller, which has been modelled by a peculiar and constant action of the muscles in the exercise of a particular and most important part of his occupation.

It is well known that all the science and tact of a miller is directed so to regulate the machinery of his mill, that the meal produced shall be of the most valuable description that the operation of grinding will permit



when performed under the most advantageous circumstances. His profit or his loss, even his fortune or his ruin, depend upon the exact adjustment of all the various parts of the machinery in operation. The miller's ear is constantly directed to the note made by the running-stone during its rotation over the bed-stone, the exact parallelism of their two surfaces, indicated by a particular sound, being a matter of the first consequence: and his hand is as constantly placed under the meal-spout, to ascertain by actual contact the character and qualities of the meal produced. The thumb by a peculiar movement spreads the sample over the fingers; the thumb in fact, employed with tact, is the gauge of the value of the produce, and hence have arisen the sayings of, "Worth a miller's thumb;" and, "An honest miller hath a golden thumb;"* in reference to the amount of the profit that is the reward of his skill. By incessant use in this way the miller's thumb acquires a form which is said to resemble exactly the shape of the head of the fish constantly found in the mill-stream, and called the Miller's Thumb, a name which occurs in Beaumont and Fletcher's comedy of Wit at Several Weapons, and also in Merrett's Pinax.

Although the improved machinery of the present time has diminished the necessity for the miller's skill in the mechanical department, the thumb is still constantly resorted to as the best test of the quality of flour.

This version of the cause of the application of the term Miller's Thumb to our River Bullhead, was communicated to me by the late John Constable, Esq., R.A.; whose father, being one of the respectable millers with which the counties of Essex and Suffolk abound, was early initiated in all the mysteries of that peculiar busi-

* Ray's "Proverbs."

ness. He also very kindly lent me a view of an undershot water-mill at Gillingham, worked by a branch of the stream from Stourhead, which is represented in the vignette on the next page.

The larvæ of water insects, ova, and fry, are the food of the Bullhead: it is voracious, and is readily caught with a small portion of a red worm. Mr. Newman, in the Zoologist for 1856, p. 5124, mentions the changes of colour which this fish undergoes on taking food, swimming briskly, or other exertion, so as quite to alter its aspect. M. Risso says it is eaten in Italy: and Pallas tells us, that in Russia this fish is used by some as a charm against fever, while others suspend it horizontally, carefully balanced by a single thread—and when thus poised, so as to have perfect freedom of motion, they believe that this fish possesses the property of indicating, by the direction of the head, the point of the compass from whence the wind blows. In Switzerland the children spear it in shallow water as it moves from the stones under which it hides. The Scandinavian Bullhead descends from the rivers into the Baltic. Cuvier recommends this fish as a favourite bait for an Eel. The late eminent naturalist, James Wilson, stated that the flesh of this Bullhead becomes red when boiled like that of the Salmon, and affords a palatable and nourishing food.

D. 6 to 9—17 or 18: P. 15: V. 3: A. 13: C. 11.

The size and form of the head have been already noticed: the mouth is wide, the jaws nearly equal; numerous small sharp teeth are in both jaws and also on the anterior part of the vomer: the irides are yellow, the pupils dark blue; on the preoperculum there is one spine curved upwards; the operculum ends in a flattened point; the dorsal fins are united by membrane; and the rays of all

the fins are prettily spotted; the general colour of the body above is dark brownish black, the sides being lighter, with small black spots; the under surface of the head and belly are white; the vent is under the commencement of the second dorsal fin. This species spawns in summer.

GILLINGHAM MILL.

SEA SCORPION, SHORT-SPINED SEA BULL-HEAD.

SUTOR, *Murray Firth.*—RÖTSIMPA, *Scandinavia.*

Acanthocottus scorpius,	GIRARD, Smithson Contrib. 1851.
Scorpius marinus,	SIBBALD, Scotia Ill. t. 17.
Cottus Scorpius,	BLOCH, pt. ii. pl. 40.
,, ,,	KLEIN, Miss. iv. pl. 13, fig. 2.
,, ,,	CUV. et VALENC. Hist. Nat. des. Poiss. t. iv. p. 160.
,, ,,	*Sea Scorpion*, JENYNS, Brit. Vert. p. 344.

ACANTHOCOTTUS. *Generic Characters.*—Head generally as high or higher than it is broad, with two pairs of bony protuberances or spines on the dorsal aspect of the cranium, and others on the face, gill-covers and shoulders to the amount of sixteen or eighteen in all: mouth more widely cleft than in *Cottus*, and the gill-membrane less extensively attached beneath: dentition and structure generally as in *Cottus*, and as in that genus the body is scaleless, but in some individuals a row or two of little, round, flat, spiniferous scales exist on the sides of the back or tail. Pancreatic cæca more numerous than in *Cottus*, or about eight. In the *Histoire des Poissons* the members of this genus are named *Chaboisseaux* or *Chabots de Mer*.

THE members of the genus *Acanthocottus* appear to belong specially to the Northern Seas; and although plentiful on most parts of our southern shore, M. Risso has not included them in his History of the Natural Productions of the Environs of Nice, which contains most of the fishes of the Mediterranean. Very various have

been the names bestowed upon the species generally, and under the term Father-Lasher two have been confounded in this country, the habits and peculiarities of both being included in one history. The Sea Scorpion, or Short-spined *Acanthocottus*, is common all round our coast, and, besides being less powerfully armed than the *A. bubalis*, or Father-Lasher, does not associate with that species. The Sea Scorpion is frequently found in estuaries or harbours, and measures commonly from four or five to eight inches in length, but Mr. Thompson states that he procured specimens in Belfast Bay having a length of ten and eleven inches. It is included in the works of M. Kroyer on the fishes of Denmark, of M. Fries and Ekström on the fishes of Scandinavia; and also by M. Nilsson in his *Prodromus*.

Like the other species of this genus, it is voracious in its appetite, and swims rapidly. There is reason to believe that this fish does not deposit its spawn at the same period of the year as the Father-Lasher: some specimens of the former, examined in the month of November, exhibited little or no appearance of roe, while female specimens of the latter, if examined at the same time of the year, will be found to contain ova of large size, which are deposited in January, and are of a fine orange-yellow colour. It has even been stated of *Acanthocottus scorpius*, that it spawns in the spring, and that the ova are as black as ink.

In its habits this species resembles the Father-Lasher, and it is found under stones and among *fuci* in the pools above low-water mark on our shores. It is very common, and every haul of a net of almost any description is nearly certain to produce examples of this species or of the other, but seldom of both in the same locality: no use, however, is made of them, and, on account of their

numerous spines, they are handled with caution, only to be thrown overboard; but if allowed to remain on the deck of the vessel, they are observed to be very tenacious of life. They feed on small crustaceans and on the fry of other fish, which their wide mouths enable them to seize without making any nicety in the selection necessary. From the noise which the Sea Scorpions make when handled, they, as well as the Gurnards, have been named by the French fishermen *Grogneurs, Coqs bruyant*, or *Coqs-de-mer*, equivalent to the Scandinavian terms *Knorr-hahn* and *See-murre*, applied also to the Gurnards. Fin-rays:—

D. 8 to 10 or 11—14: P. 17: V. 1+3: A. 11 or 12: C. 12.

The head is large, and more elevated than that of the River Bullhead; upper jaw rather the longest; teeth small and sharp: eyes large, situated about half-way between the point of the nose and the occiput; irides yellow, pupils bluish black: one pair of spines above the nostrils, with a swelling between them caused by the premaxillary pedicles; the inner edges of the orbits are elevated with a hollow depression between them, but there are no occipital spines: the preoperculum is armed with three spines, the upper one being the longest, but not reaching beyond the edge of the gill-cover; the operculum emits two spines, the upper one being the longer, and the lower one pointing downwards: there are besides a scapular and a clavicular spine on each side: the gill-openings are large; the body tapers off rapidly, and is mottled with dark purple-brown varied occasionally with rich red-brown; the belly is white; the first dorsal fin is slightly connected with the second by an extension of the membrane; the lateral line is smooth, and the ventral fins are attached posteriorly by a membrane to the belly.

The males are generally brighter in colour than the females; occasionally when in good condition the pectoral fins are striped with red, and the belly is ornamented with several pure white circular spots on a ground colour of brilliant scarlet. In the *Skandinaviens Fiskar* we are informed that the males are accounted to be poisonous by the inhabitants of the coast, but that the females are eaten by the poor.

. . . . Ex copiâ piscariâ
Consulere quid emam æquom est.

FATHER-LASHER, LONG-SPINED SEA BULLHEAD.

ROCK DOLPHIN, *Brighton.*—SUTOR, LUCKY PROACH, *Scotland.*—OX-SIMPA, *Scandinavia.*

Cottus bubalis, EUPHRASEN, Nouv. Mém. de l'Ac. de Stockh. 1786.
,, ,, CUV. et VALENC. Poiss. t. iv. p. 165, pl. 78.
,, *scorpius*, *Father-Lasher*, PENN. Brit. Zool. vol. iii. p. 294, pl. 44.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 35.
,, ,, ,, ,, FLEM. Brit. An. p. 216, sp. 156.
,, ,, *Four-spined Father-Lasher*, JENYNS, Brit. Vert. p. 345.

THE FATHER-LASHER is immediately recognised by its well-armed head and long spines, but, on our shores, it seldom measures more than from six to ten inches in length. Its aspect is forbidding. During the greater part of the year it is to be found on our coasts from Cornwall to the Orkneys, and is frequently left by the receding tide in small pools among rocks. When touched, it distends its gill-covers, and sets out its numerous spines, assuming a most threatening attitude. It spawns in December and January, the males being then very brilliant. The ova, which are very large, and of a fine orange-yellow colour, are deposited

near the sea-shore, frequently in the estuaries, and sometimes even in rivers; the fish having prepared itself for this change by its previous residence in the brackish water, after which it appears to be able to bear either extreme of freshness or saltness. Its food is small crustaceous animals, and it is said to be particularly partial to feeding on the fry of the Blennies, but in default of these nothing seems to come amiss to it. Mr. I. H. Gurney, of Easton, Norfolk, having placed a Father-Lasher two and a half inches long, in a vessel of sea-water in which were some Sand-Launces about three inches in length, observed it seize one of the latter and swallow it head foremost, the operation of deglutition lasting for an hour and a half, when the tail of the Sand-Launce wholly disappeared.—*Zool.* 2954.

D. 8—12: P. 16: V. 1+3: A. 9: C. 10.

In *Cottus bubalis* the space between the eyes is much narrower than in the *C. scorpius;* the eyes have a more vertical aspect, and the superciliary crest on each side is more elevated, nearly straight, and ends at the nape in a spine directed backwards, forming with its fellow a pair of occipital spines; irides yellow, pupils black: preoperculum edged with four spines, the upper one the longest, and reaching, says Dr. Parnell, beyond the posterior tip of the gill-cover; operculum armed with three spines; and there are besides the scapular, clavicular, and nasal spines, similar to those of *Ac. scorpius:* gill-openings large. General colour very similar to that of the last-described species, and both exhibit occasional variations in the intensity of the red, the green, and the brown tints; lateral line rough: the ventral fins in this species are devoid of the connecting membrane observable in *Ac. scorpius.* The males are the finest in colour.

Some circumstances observable in the economy of this species lead to the introduction here of a few observations on the respiration of fishes, in reference to their power of sustaining life when taken out of the water, and its supposed connection with the size of the gill-aperture.

Most writers on Ichthyology, even up to the present time, have stated that fishes with large gill-apertures, like the Herring, die soon when taken out of the water; and that, on the contrary, those with small gill-openings, like the Eel, have the power of sustaining life for a considerable time under the same circumstances. I will not say that the authors who have taken this view of the subject are in error; but I will venture to state the facts that appear to justify the belief that the duration of life in fishes, after they are taken out of water, is not altogether dependent on the size of the gill-opening.

That the Herring, the Mackerel, and many other fishes which swim near the surface, have large gill-apertures, and die almost immediately they are taken out of water, is most true; and that the Eel, with its small gill-aperture, does live for hours after it is taken out of water, is also true; but it will not be difficult to find many examples the very reverse of the instances supporting the rule, and also to show that in those fishes with large gill-apertures that do die quickly, the real cause of death has not been truly assigned.

Most of the various flatfish have large gill-apertures, and yet they are all proverbially known to be able to sustain life long after they are removed from water. Cuvier, when writing on the genus *Trachinus*, says, in the *Histoire Naturelle des Poissons*, tome iii. p. 235, "Le nom François de Vive, que ces poissons portent sur nos côtes de l'océan, et celui de *Weever*, qu'on leur donne en

Angleterre, viennent, dit-on, de ce qu'ils ont la vie dure et subsistent long-tems hors de l'eau." Yet when describing *La Vive* and its gill-apertures, the words are (at p. 239): "et l'on voit même que la fente des branchies est très-ample et s'ouvre jusque vis-à-vis la commissure des mâchoires." The two species of *Acanthocottus* just described have large heads and wide gill-apertures; yet of them it is said (tome iv. p. 159), "Ces chaboisseaux vivent très long-tems hors de l'eau."

Of fishes with large gill-apertures it is said, in the same work (tome i. p. 519), that they die, "non pas faute d'oxigène, mais parce que leurs branchies se dessèchent;" and of the Herring, that they die the instant they are taken out of the water. But may it not be objected to this view, that desiccation of the gills could not take place in so short an interval of time, and therefore could not be the cause of death? Dr. Monro calculated that the surface of the gills in a large Skate was equal in extent to the whole surface of the body of a man; yet, with this amount of surface exposed to the effects of desiccation, the different species of Skate are remarkable for the length of time they are able to sustain life after they are removed from water. Of fishes with small gill-apertures, our common Loche, *Cobitis fluviatilis*, and our most common species of the genus *Callionymus*, both die quickly. The Father-Lasher, with its large gill-aperture, will live a long time out of water, as has been already noticed; yet according to some observers, when taken out of the sea, and put into fresh water, it dies instantly.* The reverse of desiccation

* London's Magazine of Natural History, vol. ii. pp. 217 and 218. In the Zoologist for 1846 (p. 1216), Mr. Guyon, of Ventnor, in the Isle of Wight, mentions that he had transferred a Long-spined Sea Bullhead, after it had been an hour and a half out of the sea into fresh water, where it remained seven hours without seeming inconvenience, and it showed no signs of being affected by the change when returned into sea-water.

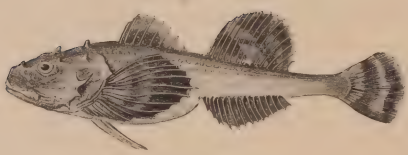
takes place in this instance: the gills are bathed with a fluid containing more oxygen than sea-water, and yielding that oxygen much easier, yet death happens immediately. In this last instance it may be inferred that the fish, unable suddenly to accommodate its respiratory organs to fluids of such different densities as those of pure sea and fresh water, the blood is imperfectly aërated, the brain is affected, convulsions ensue, and it soon dies; and, from the previous examples, may we not conclude that the power of fishes to sustain life for a time, when taken out of water, must be referred to a principle of internal organization, and is independent of the size of the gill-aperture?

M. Fleurons, a French physiologist, has explained what appears to be the true cause of death in a fish kept out of water.

If its motions be attentively watched, it will be seen that, although the mouth be opened and shut continually, and the gill-cover raised alternately, the arches supporting the branchiæ, or gills, are not separated, nor are the branchial filaments expanded—all remain in a state of collapse: the intervention of a fluid is absolutely necessary to effect their separation and extension; without it these delicate fibres adhere together in a mass, and cannot in that state receive the vivifying influence of oxygen. The situation of the fish is similar to that of an air-breathing animal enclosed in a vacuum, and death by suffocation is the consequence. To this may be added, that the duration of life in each species, when out of water, is in an inverse ratio to the necessity for oxygen. It may be observed, however, that the *Acanthocotti*, when newly caught, shut the gill-opening accurately, and, taking in air by the mouth, inflate the branchiostegous membrane to such an extent, that the bones of the gill-cover are separated, and their spines

rendered more prominent. This operation is generally adjudged to be a defensive movement of the fish, but it may also serve to produce that of separating the delicate pectinated processes of the gills, which M. Fleurons considers to be necessary for the prolongation of life.

ANCONA.



THE HORNED BULLHEAD.

HORN-SIMPA, *Scandinavia.*

Cottus quadricornis, LINNÆUS. ARTEDI, Desc. Spec. p. 77.
,, ,, BLOCH, pt. iii. pl. 108.
,, ,, CUV. et VALENC. Hist. Nat. des Poiss. t. iv. p. 168.
,, ,, *Four-horned Father-Lasher*, JENYNS, Brit. Vert. p. 345.
,, *hexacornis*, RICHARDSON, F. Bor. Am. p. 44.

I AM indebted to the communication of my friend Dr. J. E. Gray, of the British Museum, for the knowledge of the occurrence of the Four-horned Cottus on our shore; and the figure at the head of the page was drawn from a British specimen in the National collection.

This species, first made known by Artedi, is common in the Baltic, on the west coast of Norway, and in all the Arctic Seas even as far as Kamtschatka. According to Pallas it is an inhabitant of Lake Baikal, of the rivers that fall into that inland sea, of the Jenisei, and other streams that fall into the Arctic-Asiatic Sea. It also inhabits the icy sea on the northern shores of America, being very abundant at the mouth of the Coppermine River. It exists in the Swedish fresh-

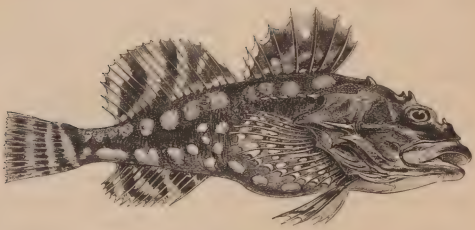
water lake Wettern. It has also been taken on the north-east coast of England by our fishermen in winter, when working nets with small meshes for Sprats; and in sorting for sale the many thousands of bushels of that fish brought to the London market, the Horned Bullhead has been occasionally found.

As a species, it is distinguished by four rough horn-like tubercles on the top of the head, from which character its name has been chosen: but Pallas observed occasional variations in the number and size of these warty excrescences, and believed that the young had for a time but two of these tubercles, and were only provided with four when they had attained the length of seven or eight inches.

The Four-horned Bullhead swims rapidly, but generally lies in ambush, near stones or among sea-weed, ready to seize its food, and it is known, by examination of the contents of the stomach, to feed very commonly on the young of the Goby. It spawns in winter, and the ova are white.

D. 8 — 14: P. 17: V. 1+3: A. 15: C. 11.

The head is large and flat, the depression in large individuals being such as to remind one of the *Platycephali*; the mouth wide, jaws equal, teeth as described in the generic characters; the irides are yellow, and the pupil black; the preoperculum emits three spines, the operculum only one; four horn-like tubercles stand on the top of the head, two of them near the eyes, and two on the nape; the body is elongated and compressed; the colour of the head brown, tinged on the gill-covers with red; the back is brown, the sides yellow, the belly greyish white; the nearly straight lateral line is marked with rough prominences, and the body also is freckled with scabrous points; the fins are prettily mottled with brown.



FABRICIUS'S SEA-BULLHEAD.

KANIOK, *Greenland Eskimos.*

Acanthocottus groenlandicus, GIRARD.
Cottus scorpius. FABRICIUS, F. Groenl. p. 156 (excl. syn.)
,, *groenlandicus*, CUV. et VALENC. Poiss. vol. iv. p. 185.
,, ,, RICHARDSON, F. Bor. Am. iii. pp. 46, 297, 314, pl. 95.
,, ,, *Greenl. Bullhead*, THOMPS. Nat. Hist. of Irel. iii. p. 81.

AN example of this species was captured in Dingle Harbour in February 1850, and exhibited in the Dublin Natural History Society, by Mr. William Andrews. As yet, this and one seen by Dr. Ball, are the only recorded examples of this fish that have been met with on our shores. The figure at the head of the article, which corresponds closely with the one published by Mr. Andrews, and the vignette at the end, are borrowed from the *Fauna Boreali Americana*, where a Newfoundland specimen is described at length.

This, Fabricius says, is a most voracious fish, and very destructive of the fry of Blennies, Salmon, Herrings, and Haddocks. It even attacks larger fish, does not spare its

own species, devours crabs and worms, and in fact pursues every living thing that it can master.* It is bold, lively, and incautious, but habitually keeps at the bottom of the sea, coming to the surface only when it is led thither in pursuit of its prey. It spawns in December and January, depositing its roe on sea-weeds. It is prized as an article of food by the Greenland Eskimos, who eat it daily both boiled and dried, and find it agreeable and wholesome for the sick. Many of them eat its eggs raw, and some even consume the fish itself in that condition. They capture it with lines armed with four hooks, disposed crosswise, and with no other bait than something coloured or shining placed above the hooks. Sometimes they spear it.

The female, Fabricius states, is larger than a male of the same age, and may be distinguished at once by its white belly, which appears yellow in the water and is spotted. The posterior cranial tubercles are nearer to each other in the males than in the females. There are four of these tubercles on the upper aspect of the head, one at each corner of an area, which in the female is nearly square and flat. There are besides eight spines on each half of the head and shoulders, viz. a nasal, opercular, subopercular, scapular and humeral one, with three preopercular ones. The principal spine is the one at the angle of the preoperculum. Its tip falls about its own length short of the point of the opercular spine. The interval between the orbits is much depressed, and is bounded anteriorly by the two nasal spines and the prominent ends of the premaxillary pedicles. There are

* The omnivorous appetite ascribed to this Bullhead by Fabricius was proved by an examination of the contents of the stomachs of several Newfoundland specimens, which consisted of the vertebral columns of several small fishes, some entire crabs, the peelings of potatoes, and other substances. These Bullheads were caught off the end of a landing jetty.

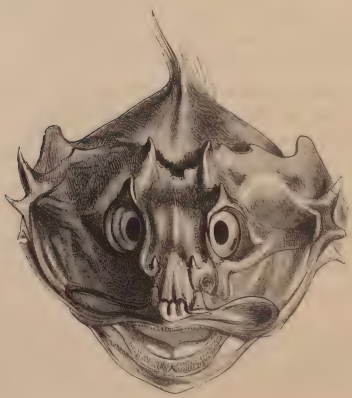
no serratures on any of the spines or bones of the head or shoulder, in which respects this species differs from the Father-Lasher.

The top of the head is sprinkled with soft conical pimples, and the skin generally is naked and smooth, but some small, circular, minutely-spiniferous scales exist on the back and posterior surfaces of the pectoral rays.

Br. 6 : D. 10—17 or 18 : A. 12 or 13 : P. 17 : V. 1+3 : C. 11½.

Colours, after the specimen had been kept in spirits, dark brown on the dorsal aspect, mixed with clay-coloured patches on the head, and crimson blotches on the gill-covers, nape and pectorals. The sides, belly, pectoral fins, and ventrals, are ornamented with circular spots of dead white, each surrounded by a dark rim. The liver has a bright red colour in the spirits.

FRONT OF COTTUS GROENLANDICUS.



THE ARMED BULLHEAD, POGGE.

LYRIE, SEA-POACHER, PLUCK, NOBLE. *Scotland.*
SKÄGG-SIMPA, *Scandinavia.*

Aspidophorus Europæus,	Cuv. et Valenc. Poiss. t. iv. p. 201.
Cottus cataphractus,	Linnæus. Bloch, pt. ii. pl. 39.
,, ,,	*Armed Bullhead,* Penn. Brit. Zool. vol. iii. pl. 43.
,, ,,	*Pogge,* Donov. Brit. Fish. pl. 16.
Cataphractus Schoneveldii,	Sibbald, pl. 15, f. 2, 3.
,, ,,	*Pogge,* Flem. Brit. An. p. 216, pl. 155.
Aspidophorus cataphractus, ,,	Jenyns, Brit. Vert. p. 346.

Aspidophorus. *Generic Characters.*—Body polygonal, forming an elongated tapering pyramid, covered with scaly plates; head thicker than the body, with points and depressions above, flattened below; teeth on the jaws only, none on the vomer; snout with recurved spines; branchiostegals six; two dorsal fins, rays simple; ventrals under the pectorals.

This easily-recognised fish was first described by Schonevelde, a physician of Hamburgh, who published in 1624 a catalogue of the aquatic animals of Silesia and Holstein: and about sixty years afterwards, Sibbald gave a figure of it in his *Scotia Illustrata.* It is now known to exist not only in the Baltic, but on the coast of Norway, and in all the Northern Seas as far as Greenland and Iceland. Mr. Couch says that it is not very common in Cornwall; and that, when found, it is most

frequently near the mouths of rivers, but occasionally it is taken far out at sea. It occurs, however, commonly enough among the refuse of trawl-nets worked in the vicinity of the Isle of Wight, and is abundant on the Lincolnshire coast. Montagu considered it to be more common on the eastern side of the kingdom than on the western shores, one or two examples only having occurred to him on the south coast of Devon. The young of small size are frequently taken by the shrimpers in most of the sandy bays at the mouth of the Thames, and of other rivers. On the Scottish coasts, where it is not unfrequent, it has been taken by Mr. Peach, at Wick and Peterhead, and it ranges northwards to the bays on the western side of Scandinavia, but Ekström thinks that it does not enter the Baltic. It seldom exceeds six inches in length; feeds on aquatic insects, and small crustaceous animals: and spawns in May, depositing the ova among stones; its flesh is said to be firm and good, but it is not used for food and is not even employed for bait.

D. 5—7: P. 15: V. 1+2: A. 7: C. 11.

The head is depressed, and wider than the body; from the edge of each operculum the body tapers gradually to the slender tail; the nose has three recurved spines; the chin and inferior edge of the gill membrane is fringed with minute cutaneous tags; the eyes have a nearly vertical aspect, the irides are yellow, the pupils black: the mouth is small; the teeth also are small, and numerous: the suborbital bone and preoperculum each end in a spine; the operculum is likewise surmounted by a spine, and there is an occipital tubercle on each side; also a scapular tubercle over the origin of each pectoral fin. The body is divided longitudinally by about eight scaly

ridges, of which those on the upper aspect are the most produced; and the whole surface is defended by rows of strong scaly plates, which are keeled lengthwise; the lateral line is straight, running between the two lateral ridges. The two dorsal fins are slightly connected by a membrane, and are of a light brown colour mottled with dark brown; the pectoral fins are large, and are crossed by a broad brown bar; the general colour of the upper surface of the body is brown, with four broad dark brown bands; the tail likewise is brown; the under surface of the body is flattened, and, with the ventral and anal fins, is very light brown, almost white. The vent is placed very forward, between the middles of the pectoral fins.

Eckström describes the liver of his Scandinavian specimens as being small and bilobate; the œsophagus as very short, wide, and bag-like; the pyloric cæca as five in number, and thick; and the intestine as making two bends. There is no air-bladder.

The same author states that in summer it frequents places of moderate depth, having a sandy or weedy bottom, but that in winter it seeks greater depths. The males approach the shores seldomer than the females, and only during the spawning season in April or May. Eckström could not learn where the ova were deposited nor how long they took to hatch. Krüyer found only 300 eggs in an adult female. Another species exists in the southern hemisphere, having been found by M. Gay on the coast of Chili, and there are several in the seas of Greenland and Kamtschatka.

THE BERGYLT, AND NORWAY HADDOCK.

Sebastes Norvegicus, Cuv. et. Valenc. Poiss. t. iv. p. 327, pl. 87.
Perca marina, Linnæus. Penn. Brit. Zool. iii. pl. 59.
Serranus Norvegicus, Flem. Brit. An. p. 212, sp. 140.

Generic Characters.—Body oblong, compressed, scaly, without cutaneous tags; the head also wholly covered with scales; eyes large: suborbitar preoperculum and operculum spiniferous; branchiostegals seven; teeth small, setaceous, stiff, numerous, uniform on the jaws, vomer, and palatines; a single dorsal fin, partly spinous, mostly flexible; inferior rays of the broad pectoral fin simple.

The peculiarly elongated second suborbitar, which characterizes the *Sclerogenidæ,* is concealed in *Sebastes* by the thickly scaly integument of the cheek, and as the fish has a percoid aspect, authors, Linnæus among the rest, have included it in the genus *Perca.* It is in fact very similar to a *Serranus,* one of the groups of the comprehensive Linnean genus *Perca,* but may be readily known by its simple inferior pectoral rays. The red colour common to the genus had obtained for the Mediterranean

species the epithet of Imperial, and Cuvier has employed the Greek equivalent to designate the genus.

Pennant having engraved his *Perca marina*, the figure supplies the means of identifying his fish with the *Sebastes Norvegicus* of Cuvier.

This species inhabits all the Northern Seas, as far westward as Newfoundland, and is frequent in the deep bays of Greenland, where it is caught with baited hooks attached to very long lines: its general food is a small species of flat fish. According to Fabricius, its flesh, though lean, is agreeable to the taste, and is eaten either cooked or dried; he states also, that the Greenlanders use the spines for needles.

Dr. Fleming obtained this fish in Zetland, where it is called Bergylt, and Norway Haddock; in several other Northern languages it is called by names that have reference to its prevailing red colour. "The late Dr. Skene," says Dr. Fleming, "observed this fish on the Aberdeenshire coast." Dr. George Johnston, of Berwick, has also obtained it on the shore of his own county; and I saw a well-preserved specimen of this fish, about twelve inches long, in the collection of Mr. John Hancock, of Newcastle-upon-Tyne; but this last example, if I recollect rightly, was obtained from the master of a Norwegian vessel. In December 1850, a specimen was caught at Lossiemouth, and presented by the Rev. James Weir to the Elgin Museum. It was eight inches long. (*Zool.* 3458.) In 1851 also I received a letter from Messrs. Dillwyn and Moggridge, announcing the capture of one seven inches long, in Swansea Bay on the 26th of October.

Fabricius states the length of the Bergylt at a cubit, Retzius at more than two feet, and Pontoppidan, who calls it *Marulke*, affirms that it attains a length of four

feet. It is named *Rödfisk* by the Swedes, *Ouger* or *Uer* by the Norwegians, and *Karfe* or *Karve*, meaning Carp, by the Islanders.

D. 15+15: P. 19: V. 1+5: A. 3+8: C. 14.

The figure here given is taken from the plate of this fish in the *Histoire Naturelle des Poissons*. The peculiarities of the head are included in the generic characters. The mouth is large, the lower jaw the longest, the numerous teeth are equal in size and small; the eyes are large, the irides yellow, the pupils dark, the head depressed: the prevailing colour on the top of the head and back is dark red, becoming lighter on the sides, and passing into a flesh-coloured silvery white on the under part of the head and body; all the fins are red; the flexible rays of the dorsal fin are elongated.

The Norwegian waters nourish a second species named the *Lilla Kungsfisken*, which brings forth living young. It is figured in the *Skandinaviens Fiskar*, pl. 49, under the name of *S. regulus*, but in the text the specific appellation is *viviparus*. A dark spot on the gill-cover and considerably larger pectorals distinguish it from *S. Norvegicus*.

The *Lilla Kungsfisken* is the *Holocentrus Norvegicus* of Hollberg (*Bohuslans fiskar*, 49, *cum figurâ*), and is named *Sjökock* and *Karing* by the fishermen of Christiana Fiord. This species may be looked for among the Zetland and Orkney Islands, but owing to its recent discovery its range has not been ascertained. It inhabits depths varying from twenty to sixty fathoms, and is taken by hooks baited for Cod-fish. So few are captured that the fishermen do not carry them to market, but eat them themselves, and find the flesh to be white and firm, much like that of the river Perch in flavour.

THE ROUGH-TAILED STICKLEBACK.

PINKEEN, SPRICKLEBAG, THORNBACK, *Ireland.* — BANSTICKLE, SHARPLIN, *Scotland.*

Gasterosteus trachurus, Cuv. et Valenc. t. iv. p. 481, pl. 98, f. 1.
,, *aculeatus*, Bloch, pt. ii. pl. 53, fig. 3.
,, ,, Donov. Brit. Fish. pl. 11.
,, ,, *Three-spined Stickleback*, Jenyns, Brit. Vert. p. 348.

Gasterosteus. *Generic Characters.*—Body generally scaleless, but the ridge of the back and the lateral line often mailed; first dorsal composed of free spines; ventral fin with one strong spine, and one branched ray; bones of the pelvis forming a cuirass, pointed behind; branchiostegals three. Swim-bladder simple, communicating by a short tube with the dorsal side of the stomach. Pseudobranchiæ present.

In Gasterosteus the second suborbitar forms the whole inferior border of the orbit, is broadly expanded over the cheek, and fills the bend of the preoperculum which it rests against; but though minutely furrowed in a radiated manner it is not traversed by an elevated ridge so as to be distinguished from the rest of the silvery integument of the cheek. On this account the connection of *Gasterosteus* with the *Sclerogenidæ* has been overlooked by many, and the keeled tail, the free dorsal spines, with the general silvery aspect and scomberoid form of body have induced some ichthyologists to place it among the *Scombridæ*.

The Rough-tailed Three-spined Stickleback is one of the smallest as well as one of the most common of our fishes, and is found both in the salt and in the fresh water: not only does almost every river, brook, and

lake produce this well-known species, but it is also common all round the coast from the Land's End to the Orkneys, and it inhabits fresh-water and sea-water indifferently.

Cuvier and Valenciennes first noticed that three species of Three-spined Sticklebacks had been constantly included under the term *G. aculeatus* of Linnæus; and the distinguishing characteristics being very obvious, all three species were shortly afterwards made known as inhabiting the waters of this country, and a figure of each given, with a short memoir, in the Magazine of Natural History, vol. iii. p. 521.

The Three-spined Stickleback was first described by Belon, and figured by Rondelet; and the history, habits, and peculiarities of the three species before referred to, have been constantly included in the accounts of one only—the *aculeatus* of authors. Willughby and Pennant figured the species now called *G. leiurus*, or the Smooth-tailed Stickleback; while Bloch and Mr. Donovan gave coloured representations of *G. trachurus*, the subject of the present article.

The Sticklebacks are active in their movements, and pugnacious in the extreme in their dispositions. A writer in the Magazine of Natural History has described their behaviour under confinement in wooden vessels of considerable size. "When a few are first turned in, they swim about in a shoal, apparently exploring their new habitation. Suddenly one will take possession of a particular corner of the tub, or, as it will sometimes happen, of the bottom, and will instantly commence an attack on his companions; and if one of them ventures to oppose his sway, a regular and most furious battle ensues: the two combatants swim round and round each other with the greatest rapidity, biting and endeavouring to pierce

each other with their spines, which on these occasions are projected. I have witnessed a battle of this sort which lasted several minutes before either would give way; and when one does submit, imagination can hardly conceive the vindictive fury of the conqueror; who, in the most persevering and unrelenting way, chases his rival from one part of the tub to another, until fairly exhausted with fatigue. They also use their spines with such fatal effect, that, incredible as it may appear, I have seen one during a battle absolutely rip his opponent quite open, so that he sank to the bottom and died. I have occasionally known three or four parts of the tub taken possession of by as many little tyrants, who guard their territories with the strictest vigilance; and the slightest invasion invariably brings on a battle. These are the habits of the male fish alone: the females are quite pacific: appear fat, as if full of roe; and never assume the brilliant colours of the male, by whom, as far as I have observed, they are unmolested."—*Magazine of Natural History*, vol. iii. p. 329.

The parental instinct is feeble, perhaps wholly absent in fishes generally, but there are some remarkable exceptions, and among these the Sticklebacks furnish us with some curious instances of nest-building and affection for progeny. A paper by Albany Hancock, Esq., published in the Transactions of the Tyneside Naturalists' Field Club, attributes the first notice of the nidification of the Stickleback to Mr. T. Crookenden, who published his observations in the Youth's Instructor for 1834. Since that time several British naturalists have made known the results of their investigations of the habits of these fish, and foreign observers have also given to the world similar notices. Of these we republish here in an abridged form the observations of S. Costa made in the Mediterranean in 1846, as

we find them reported in Wiegman's *Archiven für Naturgeschichte*. On the approach of spawning time, says M. Costa, the male builds a nest of stalks of grass and other matters in a hollow of the bottom, a little above three feet wide, and about six inches and a half deep, creeping over the materials on his belly, and cementing them with the mucus that exudes from his skin. The bottom of the nest is first laid, then the sides are raised, and lastly the top is covered over. A small hole is left on one side for an entrance. When the erection is complete, he seeks out a female, and conducting her—Signóre Costa says—with many caresses to the nest, introduces her into the nuptial chamber. In a few minutes she has laid two or three eggs, after which she bores a hole on the opposite side of the nest to that by which she entered, and makes her escape. The nest has now two doors, and the eggs are exposed to the cool stream of water, which entering by one door flows out at the other. Next day the male goes again in quest of a female, and sometimes brings back the same, sometimes finds a new mate. This is repeated until the nest contains a considerable number of eggs, and each time the male rubs his side against the female, and passes over the eggs. Next the male watches a whole month over his treasure, defending it stoutly against all invaders, and especially against his wives, who have a great desire to look at the eggs. When the young are hatched and able to do for themselves, the anxieties and active vigilance of the male cease.

Mr. Hancock's observations were made on Sticklebacks confined in a vivarium, and agree mainly with those of Signóre Costa. They are recorded in much detail, are reprinted in the Zoologist for 1854, p. 4409, and are well worthy of perusal. The Zoologist prints notices also of the nests of *Gasterosteus leiurus* and *spinachia* by Messrs.

R. Q. Couch, Kinahan and Warrington, which will be referred to in the descriptions of these species.

The wood-cut at the beginning of this article represents the Rough-tailed Stickleback of the natural size. It is a fish with a voracious appetite, which it endeavours to appease by devouring worms, insects, and the roe and minute fry of other fishes. It spawns in summer, and though each female matures but few eggs, the numbers of individuals are very great. Pennant states that a man employed by a farmer at Spalding in Lincolnshire, took such quantities, that for a considerable time he earned four shillings a day, though he was paid at the seemingly low rate of a halfpenny a bushel. They are used as manure, and attempts have been made to obtain oil from them.

The length of this fish seldom exceeds two and a half or three inches; the body is compressed; the nostrils situated in a depression are nearer to the eye than to the end of the snout; the premaxillaries are slightly protractile, and when the mouth is shut, the mandible closes up in front of them. A narrow band of teeth arms the upper and lower jaws, but the vomer, palatines and tongue are toothless. Fin-rays as follows:—

D. 3+9: P. 10: V. 1+1: A. 1+8: C. 12.

The pectoral rays are unbranched.

The dorsal spines are acutely serrated laterally, have a triangular membrane attached to each of them, and can be raised and depressed; the ventral spine, triangular at its base and styliform at the point, is more coarsely serrated exteriorly, than on its interior edge, in its axilla there is a minute jointed ray: the tip of the spine does not reach as far back as the point of the pelvic cuirass.

The sides are defended for about three-fourths of their

height by twenty-six flat, strap-shaped plates, of which fifteen are before the vent, and between the last of them and the caudal fin, there is an acute bony keel on the side of the tail. The three plates next the head are short, the fourth and fifth are overtopped at their points by the ascending branch of the pelvic bones. All are traversed vertically by even rows of minute granular points with furrows between; and on the upper third of their height a row of little points forms the lateral line. A series of plates extends also along the ridge of the back, the dorsal spines rising from the three largest. These bony plates are described in detail in the *Histoire des Poissons*, and the description agrees closely with a beautiful skeleton of a Hampshire specimen, prepared by Mr. Charles Barron, Curator of Haslar Museum. The vertebræ have a neat, smooth, hour-glass shape.

The Sticklebacks are said to live only two or at most but three years; the males are generally distinguished by the pink colour of their bellies, and both sexes are more brilliant in the spawning season. The colour of the back is green, of the cheeks, flanks, and belly, silvery white.

A difference of opinion exists as to the propriety of considering this Stickleback and the two or three which follow, to be specifically distinct. I am still inclined to agree with Baron Cuvier, Dr. Parnell and Mr. Couch, in thinking that they are really distinct. The last-named gentleman in his Cornish Fauna says, "Having kept the first and third kinds of Stickleback alive in glass vessels, I found them to manifest very different habits, and I have no hesitation in believing Mr. Yarrell to be correct in his opinion of their being specifically distinct." Dr. Parnell's observations are published in the seventh volume of the Memoirs of the Wernerian Society. On the

other side, Mr. Thompson argues strongly that the characters by which the Sticklebacks in question have been distinguished are not permanent. This controversy can be most satisfactorily decided by selecting a few individuals of one kind, placing them in a fit locality for breeding, to which no others have access, and ascertaining whether all the progeny resemble the parents or not. Heckel and Kner, in their account of the fresh-water fishes of Austria, consider the different forms of *Gasterosteus*, described by us as so many species, to be mere varieties of development of the lateral plates, which vary in number, they say, between three and twenty-eight: and they therefore restore the old name of *aculeatus* used by Linnæus and Bloch, making it to include *trachurus*, *leiurus*, or *gymnurus*, *semiarmatus*, and *semiloricatus*.

In D'Orbigny's *Dictionnaire d'Histoire Naturelle* the writer of the article *Nidification* remarks that *Gasterosteus trachurus* and *G. leiurus* constantly form their nests on the soil at the bottom of the rivulet or ditch they inhabit, but that *G. pungitius* invariably constructs its nuptial chamber upon aquatic plants, or among their roots; that the two former build nests resembling mole-hills, while the nest of the latter is like a muff, and is analogous to the nest of a Wren, or more especially to that of the Long-tailed Tit.

With respect to the economical uses of the Sticklebacks, a good and nourishing fish-soup may be prepared from them, and hogs may be fed with them. In Kamtschatka and in Rupert's Land they are stored up for the winter food of dogs, and in Eastern Russia oil is extracted from them by boiling. Elsewhere they are occasionally used as manure.

THE HALF-ARMED STICKLEBACK.

Gasterosteus semiarmatus, Cuv. et Valenc. H. Nat. des Poiss. t. iv. p. 493.

This species is distinguished from the preceding by the want of defensive plates along the sides of the tail, and in having rather larger teeth; in other respects it does not differ much, and it is considered by some as only a variety, or the young of *Gasterosteus trachurus*, that had yet by increased age to acquire the requisite number of lateral plates. I have, however, taken specimens of all sizes, which were uniform in the number of lateral plates, and close examination by a friend, who has paid particular attention to this subject, has shown that no point of ossification or induration is to be found posterior to the fifteenth and last perfect lateral plate, which seldom passes beyond the line of the vent. There is a cutaneous keel on each side of the tail, resembling that of *trachurus*, on which the ridge of skin is strengthened by small pointed plates lying over each other in the manner of tiles. The figure makes further description unnecessary. The fin-rays in number are—

D. III. + 10: P. 10: A. 1 + 9: C. 12.

It occurs in similar situations to the other Sticklebacks, but not always in company with them.

THE SMOOTH-TAILED STICKLEBACK.

Gasterosteus leiurus, Cuv. et Valenc. Poiss. t. iv. p. 481, pl. 98, f. 4.
Pisciculus aculeatus, Rondelet. · Willughby, X. 14, fig. 1.
Gasterosteus ,, Penn. Brit. Zool. vol. iii. pl. 61.

The third species is the Smooth-tailed Stickleback, in which the lateral plates, ten in number, extend no further than the ends of the rays of the pectoral fin; the whole length of the side beyond this being smooth and soft, without scale or fold, and only marked with the linear depressions produced on the surface by the divisions of the lateral muscles. In the examples of this species which I have examined, the ascending branch of the pelvic bone overlaps the points of the fifth, sixth and seventh lateral plates. The general colours of the three species are green above, passing into silvery white below. Some exhibit various shades of crimson and purple; but these colours are more frequent in males than females. Fin-rays:—

D. III. +10: P. 11: A. 1+8: C. 12.

Robert Warrington, Esq. having published his observations on the habits of this species in confinement, some

extracts from his very interesting paper are here introduced, which may be compared with M. Costa's account given in the history of the preceding species.

In May 1851, several beautiful Smooth-tailed Sticklebacks, male and female, the latter full of spawn, were introduced into a miniature pond. The male fish immediately took up certain positions, each defending his own against all intruders, with pertinacity. On the following day, one of the males was industriously employed in building a nest behind a piece of rock-work; and it was perceived that he had already constructed a small hole as round as a ring with a good broad margin. This spot he guarded with the utmost jealousy, continually starting from his post, and attacking the other fish with the most extraordinary ferocity. To quiet the turmoil, Mr. Warrington netted the pugnacious fish, but no sooner was it removed from the water, than the other Sticklebacks darted to the spot, and pulling out a mass of eggs, devoured them before the prisoner could be replaced in the vivarium.

In 1852 the building operations were more clearly seen, the place selected being a flat piece of limestone. The male fish in spawning time is described by Mr. Warrington as being beautiful beyond description. The eye of a resplendent green with metallic lustre, the under aspect of the throat and body of bright crimson, and the back ash-green, the colours glowing as if lighted up by internal heat. As the fish brought the rootlets of water-plants singly to the spot he had chosen for his nest, he seemed to try the specific gravity of each fibre, projecting it from his mouth, and if it sunk rapidly using it, but if it descended slowly, it was tried again in the same manner, when if it proved too light it was abandoned. The materials are arranged and re-arranged until the artist

succeeds to his wish, particles of sand or gravel are laid upon the fibres to keep them down, and the fish often draws his body slowly over the nest, probably to cement the materials with the mucus excreted from his skin. Sometimes he shakes the fabric, then slightly compresses it, and is off again for new material. At other times he hovers above the nest, and throwing his body into strong vibration, raises a current of water which washes away the mud and lighter particles, and again he takes pains to interlace and secure the loose ends.

The whole time occupied in accumulating materials was about four hours, during which a goodly quantity was obtained; and a small opening was carefully made with the snout near each end of the mass. The operatations of fanning out the light particles, improving their order, dibbing in the ends and loading them with gravel, went on for several days. At length the female came out of her hiding-place, her attention being apparently fixed on the nest; and immediately the male became as it were mad with delight. He darted round her in every direction, then returned to the nest, fanned it, and back again in an instant; then endeavoured to push her onwards with his snout. This not succeeding, he endeavoured to drag her to the nest by the tail or ventral spine, but failed in his purpose. She was probably deterred by seeing some minnows swimming on the other side of a glass partition in the tank, and ultimately she spawned elsewhere, while the empty nest was abandoned and neglected.—*Zoologist*, 3633. *Annals of Nat. Hist.*, 1852.

The same gentleman in 1854 observed the next stage of the breeding process in this species. On this occasion the nest constructed by the male, but not the same individual whose doings are recorded above, was built between two plants of *Vallisneria*, and prepared exactly as

before. The eggs were deposited in the night of May the 8th, the act not being seen; but the altered appearance of the female showed that she had parted with her roe, and the male who had previously been assiduous in urging her towards the nest, now violently repelled her. From this time the nest was more opened up to the action of the water and the fanning of the male fish above it, causing a current in the water, was repeated almost continuously, while the lustrous tints of his body decreased. After ten days (on the 18th), the materials of the nest were scattered, with the exception of a few wiry stems of water-moss, and a space cleared of about three inches diameter. The fish removed the mud and sand to some distance with its mouth, leaving the gravel clean. With the aid of a pocket lens Mr. Warrington now perceived the young fry in motion, having each the yolk-bag attached to its body. The male guardian moved continually across the clear space in every direction, and his vigilance was greatly taxed, for other fish in the tank larger than himself, used their utmost endeavours to snap up the young brood. The little creature, however, drove them off, seizing their fins and striking furiously at their heads and eyes. He also defeated the attempts made by a second female to deposit her eggs in the same place. As the young fry gained size and strength, they were inclined to stray, but the male parent constantly brought the stragglers back within the allotted precincts. As soon as the fry began to swim strongly, the activity of their guardian gradually relaxed, and soon after the young Sticklebacks were able to provide for their own safety, the parents, both male and female, disappeared, having probably died in some recess of the rock-work.—*Zool.*, 4947.

Mr. Kinahan, in the Proceedings of the Dublin

Natural History Society (1852), describes in detail the nests as built by this fish in the River Dodder, his account agreeing well with that quoted above from Mr. Warrington. Mr. Kinahan says, "In 1846 my attention was first called by a friend to this subject, and the observations then made have been confirmed by those of each succeeding year. The *Gasterosteus leiurus* (C. and V.) is the only species that I have been able to detect about Dublin, where it abounds in prodigious numbers. In May, June, or July, when the fish are about to spawn, the male selects a suitable spot, where the water, not too deep, runs with a current over a gravelly bottom, most frequently where clear streams empty themselves into a river. The foundation is usually laid of straws, having their ends carefully tucked into the gravel; other straws are laid across and similarly secured by the fish placing his snout on the end of each straw, and then raising his body vertically, to press it down. Confervæ and such like are then woven into a mass above, through which the water can have free passage. In the centre of this, a dome-like hollow is preserved, and on the top a small round hole, whose edges are strengthened with particular care, and rounded off by tucking in the loose fibres. Every now and then the architect pauses in his task and hovers over the nest, agitating the water with his fins, as if to try the stability of the fabric."

The whole paper, from which these abridged extracts are made, should be consulted as above, or in the *Zoologist*, 3526.

Views of the nest, and of the fish employed in constructing it, in this case the *Gasterosteus semiarmatus*, also of the female depositing her eggs, are given in D'Orbigny's *Dictionnaire d'Histoire Naturelle—Poissons*, pl. 20.

THE SHORT-SPINED STICKLEBACK.

Gasterosteus brachycentrus, Cuv. et Valenc. t. iv. p. 499, pl. 98, f. 2.

Specimens of a large Three-spined Stickleback, with very short spines, taken in the North of Ireland, have been supplied to me by William Thompson, Esq., who believed them to belong to Cuvier's species quoted above. In the number of lateral plates, this species agrees with *G. leiurus;* but the fish is of much larger size, while the spines, as may be seen by comparison, are very considerably shorter. The lateral plates do not extend beyond the limits of the pectoral fin, from whence the lateral line is a mere linear depression; and whether the examples of this fish be taken from mountain streams, those of the lower grounds, or from the sea, the water of the lowest temperature produces specimens of the largest size. According to Mr. Thompson, the vertebræ in this species are more numerous than in *G. leiurus*. The plate represents this fish of the natural size. Fin-rays:—

D. III. + 13: P. 10: A. 1 + 9: C. 12.

The above figure has shorter spines than the figure (No. 17) of Heckel and Kner's *Süsswasserfische der Östreichischen Monarchie*, but resembles it more in general aspect than it does the one in the *Histoire des Poissons*.

THE FOUR-SPINED STICKLEBACK.

Gasterosteus spinulosus, JENYNS and YARRELL.

I AM indebted to the kindness of Dr. James Stark for specimens of a Stickleback with four spines, taken in the pond of a meadow near Edinburgh in September 1830. This peculiarity in the number of spines has not, that I am aware, been made known as occurring in this country, before the exhibition of these specimens by Dr. James Stark at a meeting of the Wernerian Natural History Society in 1831. These examples were of small size, measuring only one inch and one quarter in length, and were taken with the common Three-spined Stickleback; but other examples of this Four-spined Stickleback were afterwards found by Dr. Stark in other localities, where no species but those with four spines could be taken.

Dr. Stark succeeded in keeping these diminutive four-spined fishes in tumblers, where he fed them with small leeches and aquatic insects, and found them quite as voracious, and even more pugnacious, than the more common ones with three spines.

In the MS. of John Walcott, Esq., written during a residence at Teignmouth, lent to me by his son, I find a notice also of a Four-spined Stickleback; but no de-

scription is given, nor is there any mention made of the locality from which he had obtained it. Dr. Stark observed that his Four-spined Stickleback had all the varied colours of the other species of the genus, except the bright red or scarlet sometimes found in the males. Some experiments made by this gentleman—(see Jameson's Edinburgh Journal for 1830, page 327)—show that the colour of these and some other small fishes is influenced, not only by the colour of the earthenware or other vessel in which they were kept, but is also modified by the quantity of light to which they were exposed; becoming pale when they are placed in a white vessel in darkness, even for a comparatively short time, and returning to the natural hue when exposed to the light of the sun. From these circumstances, observed also in some members of other genera, Dr. Stark is led to infer that, to a certain extent, fishes have the power of accommodating their colour to the ground or bottom of the waters which they inhabit. The final reason for this may be traced to the security this gives them from the attacks of their enemies, and we behold another beautiful instance of the care displayed by Nature in the preservation of all her species. Dr. Stark often observed that on a flat sandy coast, Flounders were coloured so very much like the sand, that, unless they moved, it was impossible to distinguish them from the bottom on which they lay. The specimens sent to me have four dorsal spines, placed at equal distances from each, with the usual broad ascending plate of the pelvic bone, covered by the pectoral fin. The fin-rays:—

D. IV. + 8 : P. 9 : V. 1 : A. 1 + 8 : C. 12.

The colour has been already noticed. The figure is double the natural size.

THE TEN-SPINED STICKLEBACK.

TINKER.—SMÅSPIGG, *Scandinavia.*

Gasterosteus pungitius, LINNÆUS.
,, ,, CUV. et VALENC. Poiss. t. iv. p. 506.
,, ,, BLOCH, pt. ii. pl. 53, fig. 4.
,, ,, *Ten-spined Stickleback*, PENN. Brit. Zoöl. iii. pl. 61.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 32.
,, ,, ,, ,, FLEM. Brit. An. p. 219, sp. 167.
,, ,, ,, ,, JENYNS, Brit. Vert. p. 350.

THE TEN-SPINED STICKLEBACK is one of the smallest of the fishes that occur on our coast, and appears to be generally distributed, though by no means so numerous as those species with only three spines. It is found, however, in most of the creeks near the coast, as well as in many of our rivers, up which it is said to migrate in shoals in the spring. In size, it varies from one inch and a half to two inches and a quarter; and is distinguished from all the other Sticklebacks by the nine or ten spines on the back, all anterior to the dorsal fin, and by its sides being perfectly smooth, without any lateral plates,—which, with the number of dorsal spines before mentioned, forms its best specific character. Cuvier, in the last edition of the *Règne Animal*, tom. ii. p. 170, hints at the existence of a second species of Ten-spined Stickleback

—the one having on the sides of the tail some carinated scales, the other (*G. lævis*, Cuvier) wanting this lateral arming. In the *Hist. Nat. des Poissons*, however, only the *G. pungitius* is retained, and a smooth tail forms part of its character. This species, like the former, was first described by Belon, and afterwards figured by Rondelet. The fin-rays are:—

D. IX. + 10: P. 11: V. 1 + 5: A. 1 + 9: C. 12.

The general colour is a yellowish or olive green on the back; sides and belly silvery white, with minute specks of black; fins pale yellowish white.

In the *Skandinaviens Fiskar*, the Swedish *G. pungitius* named *Småspigg*, *Benunge* or *Skinäling*, is described as having generally nine dorsal spines, but varying from eight to ten. The lateral line is prominent on the side of the tail, like an incipient fin. This species is not mentioned among the fresh-water fishes of Austria by Heckel and Kner.

VIRGINIA WATER.

THE FIFTEEN-SPINED STICKLEBACK.

GREAT SEA ADDER, *Cornwall.*—ROBBIE WAMBERG, *Banff.*—BISMORE, *Orkney.*—TÅNGSPIGG AND TÅNGSNIPA, *Scandinavia.*

Gasterosteus spinachia, LINNÆUS.
,, ,, BLOCH, pt. ii. pl. 53, fig. 1.
,, ,, CUV. et VALENC. Poiss. t. iv. p. 509.
,, ,, *Fifteen-spined Stickleback*, PENN. Brit. Zool. iii. pl. 61.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 45.
Spinachia vulgaris, FLEM. Brit. An. p. 219, sp. 165.
Gasterosteus spinachia, *Fifteen-spined Stickleback*, JENYNS, Brit. Vert. p. 351.
Aculeatus marinus, SIBBALD, Scot. Ill. t. 19, f. 2.

THIS STICKLEBACK, much more elongated in its form than any other of the British species, was first described and figured by Schonevelde, whose name as a naturalist has been mentioned before. It is plentiful at Peterhead, and this year, 1858, Mr. B. N. Peach found its nest near Wick. It is known on the coast of Norway, as well as in the Baltic. Mr. Low includes it in his *Fauna Orcadensis*, says it is found very frequently, and that it

has its Orkney name, from the kind of balance there made use of, called bismores. Mr. Neill and Dr. George Johnston have taken it in the Forth and Berwick Bay; from whence, southward and westward, it may be found all round our coast to the Land's End.

The Fifteen-spined Stickleback, however, though common on the coast, does not, like the other species of Sticklebacks, ascend rivers; and is rarely, if ever, taken in fresh water, its habitual residence being among the stems of fuci near the bottom. It is very voracious, swallowing indiscriminately the eggs and fry of other fishes, worms, and marine insects. The collector of minute crustaceous animals should omit no opportunity of examining the stomachs of littoral fishes, and of this species particularly. I have found in them numerous examples of the genus *Mysis*—the Opossum shrimp of Montagu, described and figured in the ninth volume of the Transactions of the Linnean Society, page 90, tab. 5, fig. 3, and so named from the female having a pouch on the abdomen, formed by four concave scales turned upwards, in which she carries the ova, and afterwards the young. The species of this genus form the subject of the second memoir of the Zoological Researches of Mr. J. V. Thompson, of Cork.

For the following account of the habits of the Fifteen-spined Stickleback I am indebted to Mr. Couch:—"It keeps near rocks and stones clothed with sea-weeds, among which it takes refuge upon any alarm. Though less active than its brethren of the fresh water, it is scarcely less rapacious. On one occasion, I noticed a specimen, six inches in length, engaged in taking its prey from a clump of oreweed; in doing which, it assumed every posture between the horizontal and perpendicular, with the head downward or upward, thrusting its pro-

jecting snout into the crevices of the stems, and seizing its prey with a spring. Having taken this fish with a net, and transferred it to a vessel of water, in company with an Eel of three inches in length, it was not long before the latter was attacked and devoured head foremost—not, indeed, all together, for the Eel was too large a morsel, so that the tail remained hanging out of the mouth; and it was obliged at last to disgorge the Eel partly digested. It also seized from the surface a moth that fell on the water, but threw up the wings. The effect of the passions on the colour of the skin in the species of the genus *Gasterosteus* is remarkable;* and the specimen now spoken of, under the influence of terror, from a dark olive with golden sides, became pale for eighteen hours, when it as suddenly regained its former tints. It spawns in spring; and the young, not half an inch in length, are seen in considerable numbers at the margin of the sea in summer."—*Couch's MS.*

The Fifteen-spined Stickleback makes its nest of seaweed or common coralline, and ventilates and guards the spawn deposited therein with the same vigilance and courage that are exhibited by the small fresh-water species. This fact was communicated by Dr. Johnston to the Berwickshire Naturalists' Club in 1839, and it was verified by the observations of Mr. Duncan of Eyemouth, the Rev. Mr. Turnbull and Mr. Maclaren of Coldingham. Mr. R. Q. Couch ascertained the same thing independently in 1842 and 1843, and both he and Mr. Hancock have written papers on the subject.—*Zool.*, pp. 795 and 4409. In the Naturalists' Library also, vol. iv. p. 71, a figure and description of the nest are given.

The length of this species is from five to seven inches. The jaws are elongated, the under one most so; the

* See Magazine of Natural History, vol. iii. p. 329.

mouth small; the eye placed half-way between the point of the nose and the end of the gill-cover; the irides silvery, the pupil black; the head flat: the form of the body pentagonal, the tail depressed; the lateral line protected throughout by a series of carinated scales. The fin-rays are:—

D. XV. + 6: P. 10: V. 2: A. 1 + 7: C. 12.

The fifteen dorsal spines, curved backwards, are each furnished with its little membrane, and the last spine is the longest and most curved; the belly is cuirassed by two elongated pelvic bones, having about midway on their inner edges, two unequally-sized ventral spines: the colour of the upper part of the head, body and tail, is greenish brown, the sides inclining to yellow; silvery white on the cheeks, gill-covers, under part of the head, and belly; the dorsal and anal fins have each a black spot on the anterior part.

In the *Skandinaviens Fiskar*, the hues of this species, as existing in the northern seas, are thus described. "Beautiful tints of colour ornament this fish. Its dorsal aspect is a reddish-olive, the tail and head beneath yellowish, and the belly silvery. The sides are somewhat pellucid, so that the lateral processes of the vertebræ can be obscurely seen. Below the lateral line the colour is silvery, traversed by a single row of large, semi-oval olivaceous spots. A black line passes from the angle of the mouth through the eye to the upper border of the gill-cover. The pectoral fins have a bronze lustre; anteriorly the dorsal and anal fins are brown with yellow lines, posteriorly diaphanous. The caudal fin is olive at the base, pale and translucent at the end."

THE STRIPED SURMULLET.

Mullus Surmuletus, Linnæus. Bloch, part ii. pl. 57.
,, ,, Cuv. et Valenc. Hist. des Poiss. t. iii. p. 433.
,, ,, *Striped Surmullet* Penn. Brit. Zool. iii. p. 368, pl. 64.
,, ,, ,, ,, Donov. Brit. Fish. pl. 12.
,, ,, ,, ,, Flem. Brit. An. p. 216, sp. 153.
,, ,, ,, ,, Jenyns, Brit. Vert. p. 337.
,, ,, ,, ,, Thomps. Nat. H. of Irel. iii. p. 70.

Mullidæ. *Family Characters.*—Body thick, nape and shoulder arched, belly flattish; scales large, strongly ctenoid, easily detached, extending with little diminution of size to the cheeks and gill-covers: mandible furnished with a pair of symphysial barbels, which are laid up between the limbs of the bone when not in action. (The barbels are absent in the foreign genus *Acropoma*.) A high, narrow, preorbitar. Mucoducts of the lateral line branching on the scales which protect the line. Mouth small: teeth feeble. Dorsals two. Numerous pancreatic cæca.

Mullus. *Generic Characters.*—Face high. A band of very small teeth on the mandible, and a disk of pavement-like ones on the vomer, but none on the premaxillaries. No opercular spine nor any serratures on the gill-cover. Seven branchiostegals. No air-bladder.

The Greeks denominated this genus *Triglé*, and Pliny, who translates the word as it occurs in Aristotle by *Mullus*, characterizes the fish accurately by its red colour and the pair of barbels attached to the chin. Cuvier states

that the Greek name had reference to a belief that the fish spawned thrice in the year, and the Latin one to the colour of the fish, like that of the sandals worn by the Alban kings, and afterwards by the Roman consuls.

The characters which distinguish the two species of Surmullet common in the Mediterranean, both entitled to a place in the Catalogue of British Fishes, have been long known, and figures of both are given in Willughby's *Historia Piscium*, plate S. 7, figs. 1 and 2. One species, the well-known Striped Surmullet, is of frequent occurrence along the extended line of our southern coast from Cornwall to Sussex, but becomes more rare in proceeding from thence northward by the eastern coast. An instance of its capture at Gamrie, in the Murray Firth, is recorded in the Zoologist for 1851, p. 3282; and it was included in Dr. Patrick Browne's list of Irish Fishes drawn up in 1774. Mr. Thompson mentions the capture of one at Ventry in 1849, and of another in Dublin Bay in 1850.

So much were these fish in estimation among the Romans, that a Surmullet of large size appears always to have been an object of particular admiration, and sometimes of contention. A fish of three pounds' weight produced a considerable sum to the fortunate fisherman, while the cost of a fish of four pounds and a half, says Martial, was ruinous. One of six pounds is recorded to have produced a sum equal to 48*l.*; one still larger, 64*l.*; and even 240*l.* were given for three of very unusual size, procured on the same day for a repast of more than usual magnificence. The Striped Surmullet is the species which, occasionally, attains to so enviable a size in the Mediterranean; the second species, which on our coast is very rare, is much smaller, but more beautiful in colour, and on that account was shown in vases of glass by the Romans to their friends and guests. That people

kept Surmullets in their *vivaria;* but, while thus confined, the fish did not increase in size. At the present time, the Surmullets of Provence and Toulon are in high estimation. The flesh is white, firm, of good flavour, and being free from fat, is considered easy of digestion. The liver is the part of the fish in the greatest request. On our own coast, the Striped Surmullet seldom exceeds fourteen inches in length, and even this would be considered a fish of large size. The largest for which I possess any authority occurred several years since. This Surmullet weighed three pounds six ounces, was in the highest perfection, and beautiful in colour. It was sent from Weymouth as a present to the late Thomas Palmer, Esq., of Berkeley Square.

The Striped Surmullet has been considered to be a migratory fish; but it appears in the shops of the London fishmongers throughout the year, though in much greater plenty during the summer, at which time its colours are most vivid, and the fish is in the highest condition. If closely examined, it will be observed that where the scales happen not to have been removed, the natural colour is little more than a pale pink, passing into white on the belly, the lower part of the sides having three or four yellow longitudinal stripes; but that the mixture of purple and bright red which ornaments various parts of the fish is the consequence of violence: every scale removed by force—and but little is required—increasing the depth of colour; the deep tint is produced by extravasated blood lying under the transparent cuticle, but above the true skin.

These fish take a wide vertical range in the water. Many are caught in Mackerel-nets near the surface, while roving from place to place; but the principal supply is derived from the trawl-net, which traverses the bottom,

and encloses these and other fish in a manner that will be hereafter described. The Surmullets are taken sometimes in profusion, at other times they are exceedingly scarce, owing to the fish shifting or changing their ground, and remaining unmolested till accident or perseverance betrays their new locality, which on the southern coast is sometimes several miles east or west of their previous position. In Cornwall, Mr. Couch says, the Surmullet abounds near the shore in summer, but goes into deeper water in the winter, and is then only taken in the trawls.

So abundant are these fish on our southern coast occasionally, that in the month of August 1819, five thousand were taken in one night in Weymouth Bay. Mr. Paget and his brother, in their sketch of the Natural History of Yarmouth and its neighbourhood, say, that in some Mackerel seasons, the Surmullet is abundant, in others scarcely seen; ten thousand were sent from thence to the London markets in one week during the month of May 1831.

The Striped Surmullet spawns in the spring, and the young are five inches long by the end of October. The food appears to be selected from among the softer crustaceous and molluscous animals. In connection with their search for food, the long barbels articulated to the mandible require to be noticed. These barbels are mostly found in fishes that are known to feed very near the bottom. On dissecting these appendages in the Surmullet, the common Cod, and others, I found them to consist of an elongated and slender flexible cartilage, invested by numerous longitudinal muscular and nervous fibres, and covered by an extension of the common skin. The muscular apparatus is most apparent in the Surmullet, the nervous portion most conspicuous in the Cod. They

are, I have no doubt, delicate organs of touch, by which all the species provided with them are enabled to ascertain, to a certain extent, the qualities of the various substances with which they are brought in contact, and are analogous in function to the beak, with its distribution of nerves, among certain wading and swimming birds which probe for food beyond their sight. This may be considered another instance, among the many beautiful provisions of Nature, by which, in the case of fishes feeding at great depths, where light is deficient, compensation is made for consequent imperfect vision.

The fin-ray formula is as follows:

D. 7—1+8 : P. 17 : V. 1+5 : A. 2+6 : C. 13.

The forehead, nape, cheek, and operculum are covered with scales; irides pale yellow; mucous pores abundant; the teeth and the colours of the body have been already noticed; the membrane of the first dorsal fin is tinged with yellow, that of the other fins transparent; the axilla of the ventral fin is furnished with a pointed scale, and the vent is placed under the commencement of the second dorsal fin.

SIMPLICITAS ET PUERITIA.

THE PLAIN SURMULLET.

Mullus barbatus, Linnæus.
,, ,, Cuv. et. Valenc. Poiss. t. iii. p. 442, pl. 70.
,, ,, Bloch, pt. x. pl. 348, fig. 2.
,, ,, *Surmullet.* Penn. Brit. Zool. vol. iii. p. 365.
,, ,, *Red Mullet*, Couch, MS.
,, ,, ,, *Surmullet*, Jenyns, Brit. Vert. p. 338.

Pennant admitted this fish into his British Zoology on account of one taken on the coast of Scotland, but which it does not appear he had any opportunity of examining. Mr. Couch, according to the manuscript, obligingly lent for this work, has had the good fortune to obtain two specimens of this very rare Mullet on the coast of Cornwall; which are described as showing one yellow line a little below the lateral line, the sides and part of the belly dark red, and the back lighter in colour than the Striped Surmullet. A specimen of this Plain Surmullet in the collection of the British Museum, and another in my own possession, have the colour of the most delicate carmine on the back and sides, the belly

silvery white, but without any appearance of a yellow line, and very similar to the coloured figure in Bloch, plate 348, fig. 2, and the figure in the coloured copies of the work of Cuvier and Valenciennes, plate 70.

Since the publication of the first edition of British Fishes, a specimen has been taken on the coast of Berwickshire, as recorded by Dr. George Johnston of Berwick.

The habits of this species are stated to be the same as those of the Striped Red Mullet, and the number of fin-rays is as follows:—

D. 7—1+8: P. 16: V. 6: A. 1+6: C. 15.

The positions of the fins differ a little in the two species, as shown in the woodcuts, and the colour of the connecting membrane is a pale yellow: the irides also are yellow, the scales somewhat smaller in size than those of the Striped Surmullet, and equally deciduous, but decidedly distinct in structure, as the vignettes show. *Barbatus* is not a distinctive term, the barbels being common to all the genus. The head is remarkable for steepness of the profile, and the fish seldom exceeds six inches in length.

A scale from the lateral line of each fish is added in farther proof of the distinction of the species; that on the right hand is from the Plain Surmullet, the other is from the Striped Surmullet.

THE MAIGRE.

Sciæna aquila, Cuv. et Valenc. Poiss. t. v. p. 28, pl. 100.
Umbra Rondeletii, Willughby, p. 299, tab. S. 19.
Chélodiptere aigle, Lacepede, v. p. 685.
Sciæna aquila, Flem. Brit. An. 213, sp. 144.
,, ,, *Maigre,* Jenyns, Brit. Vert. p. 352.

Sciænæ. *Family Characters.*—Bones of the head and face full of muciferous cells and excavations; mouth but little protractile; vomer and palatines toothless; branchiostegals seven; operculum spiniferous, or denticulated; preoperculum variously armed. Scales ctenoid, but often thin and tender, and for the most part obliquely arranged. Air-bladder often curiously lobed or fringed. Dorsals two, or one only.

Sciæna. *Generic Characters.*—Head convex, with cellular bones. Two dorsals, one deeply notched, the soft part longer than the spinous one; anal short. Preoperculum denticulated; operculum ending in points with a curve in the bone between. Otolites large. Air-bladder complicated. Stomach cæcal. Pancreatic cæca ten or more. Anal spines feeble.

The limited space to be devoted to each species in this work, will not allow me to follow Cuvier and Valenciennes through the long chain of historical research by

which they have succeeded in clearing the European *Sciænædæ* from the obscurity in which they were involved by the older writers. This important branch of Ichthyological history, for which Baron Cuvier was so eminently qualified by his great talents and acquirements, his excellent memory, and the extensive materials by which he was surrounded, forms one of the most valuable features of all that part of the work on fishes he was spared to accomplish. It may be sufficient here to state, that, in the *Histoire Naturelle des Poissons*, the three best-known species of the Mediterranean Sea have been considered as types of three genera, two of which belong to the catalogue of British Fishes.

The name of *Sciæna*, as a generic term, has been given to the species which exhibit the peculiarities included in the generic characters, of which *Sciæna aquila*, the *Maigre* of the French, is the typical, or most characteristic example. This large and remarkable fish is common in certain localities, and is celebrated for the goodness of its flesh. Salvian has correctly described it under the name of *Umbrina*, though he knew it to be the *Maigre* of the French. Rondelet calls it *Peis Rei* (Royal Fish). It appears always to have been in great request with epicures; and, as on account of its large size it was always sold in pieces, the fishermen of Rome were in the habit of presenting the head, which was considered the finest part, as a sort of tribute to the three local magistrates who acted for the time as conservators of the city.

Paulus Jovius relates a curious history of the head of one of these fishes, presented, as usual, to the conservators in the reign of Pope Sextus X.; given by them to the Pope's nephew; by him to one of the Cardinals; from whom it passed as a noble donation to his banker, to whom he was deeply indebted; and from the banker

to his courtesan. It was followed with keen scent through all its migrations by a parasite, whose industry was rewarded at length, by his being allowed to partake of the feast. This story forms much of the underplot of Beaumont and Fletcher's "Woman-Hater;" where, as the condition of his becoming a sharer in the exquisite morsel, the parasite is made to marry the courtesan, with whom the head finally rested.

The Maigre, however, seems almost to have become forgotten at Paris; and Duhamel has afforded a clue that explains why. The fish has shifted its ground; and had, at the time the observation was made, taken up a new locality, nearly a hundred leagues distant from its previous position.

The southern side of the Mediterranean appears to be the situation in which the young of the Maigres are produced in the greatest numbers; and examples of small size have been brought from Egypt. The specimens that are taken on the northern shore are usually of large size. At Genoa, this fish is called *fegaro;* and at Nice, according to M. Risso, *figou*, and *vanloo*.

The Maigre is occasionally taken off the coast of Spain; and Duhamel considered it to be a fish that wandered continually, generally swimming in small shoals, and seldom remaining long in a place. In 1803, the fishermen of Dieppe caught nine or ten of these fishes, which were unknown to them before, and to which they gave the name of *aigle*. Specimens have also been taken occasionally since; and it has been observed, that, when these fishes are swimming in shoals, they utter a grunting or purring noise, that may be heard from a depth of twenty fathoms; taking advantage of this circumstance, three fishermen once took twenty Maigres by a single sweep of their net. They are described as possessing great

strength, frequently upsetting the men in their struggles; and they are accordingly knocked on the head as soon as they are got into the boat.

As we advance northward, the Maigre becomes more rare. One specimen, five feet four inches in length, was taken in Zetland, in November 1819, as recorded by Mr. Neill. It was first observed by some fishermen, as it was endeavouring to escape from a Seal; and when taken into the boat, made its usual purring sort of noise. A second specimen was taken in a seine-net, at Start Bay, on the south coast of Devon, in August 1823, as communicated to the Zoological Society by the Rev. Robert Holdsworth. In September 1834, I saw a fine specimen, five feet two inches long, in the collection of Mr. John Hancock, of Newcastle-upon-Tyne, which had been taken on the coast of Northumberland, and preserved by himself; since that time I have seen five fresh specimens, four of which were brought to the London market, and I have heard of four others; these were taken along the line of our southern coast, where they are sometimes called Stone Basse, and occasionally confounded with the *Labrax* and *Acerina*. Part of the flesh of these examples was eaten by several persons, and by all reported to be good, particularly by those who cooked their portions by stewing. When plain boiled only, it was rather dry and tasteless. The two hard bones or *otolites* usually found just within the sides of the head in fishes, and which belong to the acoustic organs, are larger in proportion in the Maigre than in any other fish, and were supposed, the older writers say, to possess medicinal virtues. According to Belon, they were called colic-stones, and were worn on the neck, mounted in gold, to secure the possessor against this painful malady: to be quite effectual, it was pretended that the wearer must have received them as a gift; if they

had been purchased, they had neither preventive nor curative power. These ear-bones are well represented by Klein, tab. 4, D. D.

Since the publication of the second edition of the British Fishes several instances of the capture of the Maigre on our shores have been recorded in the pages of the Zoologist. One, Mr. Couch states, was taken at Mevagissey in the autumn of 1843, which measured six feet and weighed four hundred pounds; and another at Fowey in the winter of 1844. One five feet long was captured near Redcar, on the Yorkshire coast, in December 1849, and in 1850 a smaller one was taken off Brixham, and sent by railway to Billingsgate. Mr. Thompson, from whose Natural History the last instance is quoted, records the taking of one off Cork, which was six feet four inches long. Dr. Baikie, moreover mentions in the Zoologist (3952), that Dr. Duguid caught one in the Orkneys in 1852. In addition to these quotations, I have to add a notice from Mr. Tracey of Dartmouth, of the capture of one at that port, and to mention a specimen sent to me by H. F. Spence, Esq., in August 1849, from the same coast.

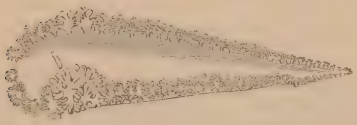
The Maigre is seldom taken less than three feet, and sometimes over six feet, in length. It has much of the general external appearance of a large Basse, but differs in having the tongue and the whole of the roof of the mouth quite smooth, and a shorter and more rounded head. The mouth is furnished with one row of distinctly-separated teeth in each jaw, pointed and curved, with a few smaller ones among those of the mandible, and a row of smaller ones behind those of the upper jaw; the eye is placed high up on the head, distant about twice its own diameter from the end of the nose; and the nostrils are pierced between these two points, but nearer to the eye.

In three of the specimens I had opportunities of examining, the serratures of the preoperculum were nearly obliterated, probably by age: the fin-rays were in number—

D. 9—1+27: P. 16: V. 1+5: A. 1+8: C. 17.

and the membranes of the fins and the tail were very much worn: the lateral line is parallel to the line of the back throughout its length. When quite fresh, the colour of the body is a uniform greyish silver, slightly inclining to brown on the back, and lightest on the belly; but after keeping some days, the colours become much darker. All the fins are reddish brown; the first dorsal, the pectoral, and ventral fins, being rather more red than the others. The swimming-bladder in this species is peculiarly fringed all round its edge. The figure of it here given is from the work of Cuvier and Valenciennes, before referred to.

SWIM-BLADDER OF THE MAIGRE.



THE UMBRINA.

Umbrina vulgaris, Cuv. et Valenc. Poiss. t. v. p. 171.
Sciæna cirrosa, Linnæus. Bloch, pl. 300. Jenyns, Brit. Vert. p. 353.

Umbrina. *Generic Characters.*—Body compressed, scaly: head blunt, wholly scaly, except the jaws and maxillaries. Premaxillaries retreating under the lobed or notched edge of the preorbitar. Teeth setaceous, crowded on the jaws without canines, none on the vomer or palate: pharyngeal teeth cylindrical with flat crowns, bounded before and behind by crowded setaceous ones. A barbel and four pores on the chin. Dorsals two approximated. Branchiostegals seven. Air-bladder large, nacry, sinuated, but not fringed.

The Umbrina is a beautiful and excellent fish, which, though it does not attain the size of the Maigre, is frequently taken two feet in length, and has been known to weigh forty pounds. It is very common on the coasts of Italy, France, and Spain. The flesh is white and of good flavour, and in considerable request, even at the best tables. Its food is small fishes, mollusca, and a particular sort of sea-weed.

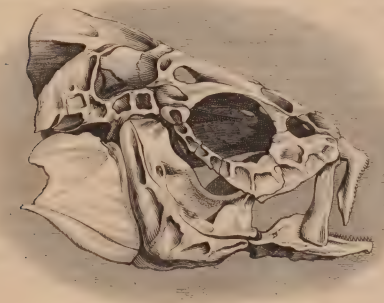
On the British coast it appears to be a very rare visitor. "In 1827, a fish, unknown to the oldest fisherman, was

taken in the river Exe, which proved to be identical with that known at Gibraltar by the Spanish name of Umbrina, the *Sciæna cirrosa* of Linnæus."—(Minute-book of the Linnean Society.)

The head is short and blunt; the irides silvery, the pupil black; the upper jaw considerably the longest; there are three large mucous pores near the point of the nose; the preoperculum is denticulated while young, but becomes smooth by age; the operculum ends in a flattened point directed backwards, the lowermost of the two acute points of the gill-cover belonging to the suboperculum.

D. 10—22: P. 17: V. 1+6: A. 2+7: C. 17.

The lateral line runs parallel with the dorsal profile, but nearer to it than in the Maigre; the scales are large and rhomboidal; the yellowish ground colour of the body is traversed obliquely from the back downwards and forwards with bands of silver and blue; the belly is white; and the dorsal fins brown, the second fin being marked with two bars; the pectoral and ventral fins are nearly black; the anal fin red.



THE PERCH.

ABORRE AND TRYTE, *Scandinavia.*—FLUSSBARSCH, *Germany.*

Perca fluviatilis, LINNÆUS. BLOCH, pt. ii. pl. 52.
,, ,, CUV. et VALENC. Poiss. t. ii. p. 20.
,, ,, *Perch*, PENN. Brit. Zool. vol. iii. p. 345, pl. 59.
,, ,, ,, DONOV. Brit. Fish. pl. 52.
,, ,, ,, FLEM. Brit. An. p. 213, sp. 142.
,, ,, ,, JENYNS, Brit. Vert. p. 330.

PERCÆDÆ. *Family Characters.*—Body scaly; scales ctenoid; opercular bones variously armed. Teeth on the jaws and vomer, and most frequently on the palatines. Seven branchiostegals. Cheek not cuirassed; no barbels. Ventrals of five jointed rays and a spine, thoracic or sub-brachian. Fins always amounting to seven, often to eight. Pyloric opening of the stomach lateral with a cæcal part of the viscus beneath; pancreatic cæca few and not bulky: intestinal canal with few folds.

PERCA. *Generic Characters.*—Dorsals two. Preoperculum denticulated, suboperculum more feebly so, operculum ending in one or two, often three spinous points. Tongue smooth. Cheeks scaly.

BARON CUVIER has chosen the Perch as the type of *Perca*, but has separated many groups from that genus, as it was established by Linnæus; and in framing the family character given above, all the Percoids of Cuvier

that have fewer branchiostegals than seven, or ventrals not placed under the pectorals, or other than the normal number of five articulated ventral rays, have been also excluded.

The Perch was well known to the Greeks, and Aristotle has described its habits under the name of Πέρκη. It was the *Perca* of the Romans; and is called *Pergesa* in Italy, *Börs* or *Persch* in Prussia, *la Perche* in France, and *Perch* in England. As a species, it is common to the whole of the temperate parts of Europe; and in England there is scarcely a river or lake of any extent wherein this fish does not occur. It is found also in the lakes of Wales. In Ireland, Mr. Thompson says the Perch is found from north to south, but is not universally distributed in the rivers and lakes. A friend who writes in the Magazine of Zoology and Botany, says of the Perch in Scotland, that it is only sparingly met with in the lochs north of the Forth; and in one or two places where it is found beyond Perthshire, its introduction may be traced to no distant period. In all the almost countless waters of the more northern counties, it is said to be wanting; nor is it included by Low among his Fishes of Orkney and Zetland. Still farther north, however, it again occurs, as an inhabitant of Scandinavian waters up to the sixty-ninth parallel. In rivers, the Perch prefers the sides of the stream rather than the rapid parts of the current, and it feeds indiscriminately upon insects, worms, and small fishes. So remarkable is the Perch for boldness and voracity, that in a few days after some specimens had been placed in a vivarium, in Bushy Park, Mr. Jesse tells us, they came freely and took worms from his fingers; and the Perch is generally the first prize of the juvenile angler. It has been known to breed in small vases; and Bloch mentions having watched some while

depositing their ova in long strings in a vessel kept in his room. A Perch of half a pound weight has been found to contain 280,000 ova; and the spawning season is at the end of April or beginning of May. Perch live for some hours out of water, and bear a journey of forty or fifty miles, if carried steadily, and watered occasionally. They are constantly exhibited in the markets of Catholic countries; and, if not sold, are taken back to the ponds from which they were removed in the morning, to be reproduced another day. The flesh of this fish is firm, white, of good flavour, and easy of digestion.

A Perch of three pounds' weight is considered to be of large size; individuals, however, of four pounds have been taken from the Richmond Park ponds. Mr. Donovan, in his History of British Fishes, records the capture of one of five pounds in Bala Lake. Mr. Hunt, of the Brades, near Dudley, Staffordshire, took a Perch of six pounds from the Birmingham Canal. Montagu once saw a Perch of eight pounds taken in the Avon, in Wiltshire, by a runner, or night-line, for a Pike baited with a Roach: and one of eight pounds was caught in Dagenham Breach. Pennant records his having heard of one that was taken in the Serpentine River, Hyde Park, that weighed nine pounds; and it is stated by Schäffer that the head of a Perch is preserved in the church of Lulea in Lapland, which measures nearly a foot in length.

The body of the Perch is compressed, and its height is about one-third of its whole length. The length of the head is equal to the height of the body, and compared to the length of the body is as two to seven: the jaws are nearly equal, and the opening of the mouth is about one-fourth of the whole head: the teeth are small, curving backwards, and of equal height, and the inside of the

mouth is furnished with a transverse membrane before the palate as in most fishes. There are two external openings to each nostril, surrounded by several muciferous orifices. These apertures are larger and more numerous about the heads of fishes generally than on the other parts, and their distribution is one of those beautiful and excellent provisions of nature which are so often to be observed and admired. Whether the fish inhabits the stream or the lake, the current of the water in the one instance, or progression through it in the other, carries this defensive secretion backwards, and spreads it over the whole surface of the body. In fishes with small scales, this lubricating fluid is poured out more abundantly; and in fish with elongated bodies, such as the Eels, rows of the mucous orifices may be observed along the whole length of the lateral line.

The fin-rays are—

D. 15—1+13: P. 14: V. 1+5: A. 2+8: C. 17.

In counting the rays of the caudal fin, those only from the longest ray of the upper portion to the longest ray of the lower portion, both inclusive, are enumerated.

The Perch is not only one of the most common, but also one of the most beautiful of our fresh-water fishes; and, when in good condition, its colours are brilliant and striking. The upper part of the body is a rich greenish brown, passing into golden yellowish white below; the sides are ornamented with from five to seven dark transverse bands; the irides are golden yellow; the first dorsal fin brown, and the membrane connecting two or three of the foremost and hindermost rays is spotted with black; the second dorsal and pectoral fins are pale brown; the ventral, anal, and caudal fins, bright vermilion.

A deformed variety of Perch, with the back greatly

elevated, the tail distorted, and bearing the local name of *Rudaborre*, was noticed by Linnæus at Fahlun, in Sweden; and similar monstrosities occur at Elgsjön in Ostrogothia, and in other lakes in the North of Europe. Deformed Perch are also found in Llyn Raithlyn, in Merionethshire. Such a fish is figured in the volume of Daniel's Rural Sports devoted to Fishing and Shooting, page 247. Perch, almost entirely white, inhabit the waters of particular soils, and I am indebted to the kindness of G. S. Foljambe, Esq., of Osberton, for specimens of a variety of Perch from Ravenfield Park ponds, near Rotherham, in Yorkshire, the seat of Thomas Walker, Esq.; these, when received in London, were of a uniform slate-grey colour with a silvery tint, and this peculiarity of colour is retained when the living fish are transferred from the park ponds to other waters.

Thomas Hurtley, in his account of some natural curiosities in the environs of Malham, in Craven, Yorkshire, when writing of the fish of Malham Water (called provincially Maum Tarn), says, of the Perch, "There is certainly a very extraordinary phenomenon attending them, the cause of which I leave to naturalists to ascertain. After a certain age they become blind: a hard, thick, yellow film covers the whole surface of the eye, and totally obscures the sight. When this is the case, the fish generally are exceedingly black; and although, from the more extreme toughness and consistency of the membrane covering the eye, it is evident that some have been much longer in this state than others, yet there appears to be no difference either in their flavour or condition. Perch of five pounds' weight, and more, have been taken. They are only to be caught with a net that sweeps the bottom, where they feed on Loaches, Miller's Thumbs, and testaceous mollusks."

It is not improbable that the increased density and opacity of the cornea here described may be one of the effects of inflammation produced by some of the numerous very minute leech-like animals, which M. Nordmann has found to occur so frequently in the aqueous humours of the eyes of fishes.*

The vignette below represents a scale from the lateral line of the Perch, the Basse, and the Ruffe.

* Mikrographische Beiträge zur Naturgeschichte der wirbellosen Thiere von Dr. Alexander v. Nordmann. Berlin, 1832.

THE BASSE.

Labrax lupus, Cuv. et Valenc. Poiss. t. ii. p. 56, pl. 11.
Perca Labrax, Linnæus. Bloch, pt. ix. pl. 301.
,, ,, *Basse*, Penn. Brit. Zool. 1812, vol. iii. p. 348, pl. 60.
,, ,, ,, Donov. Brit. Fish. pl. 43.
,, ,, ,, Flem. Brit. An. p. 213, sp. 143.
,, ,, *Common Basse*, Jenyns, Brit. Vert. p. 331.

Labrax. *Generic Characters.*—Body fusiform, scaly. Gill-covers and cheeks also scaly; scales ctenoid. Preorbitar naked, smooth-edged; suboperculum and coracoid also entire on the margin; preoperculum serrated above, divergently retrospinous below. Teeth small, setaceous, crowded on the jaws vomer and palatines, also a patch on the tongue. Two dorsals. (*Percolabrax*, Schlegel.)

The Basse, a marine Perch, with two dorsal fins, abundant in the Mediterranean, was well known to the Greeks, who called it Λάβραξ, and esteemed it highly. Aristotle distinguished it from the fresh-water Perch by the scales on the various parts of the gill-cover, the spines of the operculum, and the roughness of the tongue. It was also well known to the Romans, who

called it *Lupus*, on account of its voracity; and these terms Cuvier has united to designate it according to modern science.

> "But say by what discernment are you taught
> To know that this voracious *Basse* was caught
> Where the full river's lenient waters glide,
> Or where the bridges break the rapid tide:
> In the mid-ocean, or where Tiber pays
> With broader course his tribute to the seas."
>
> Hor. *Sat.* ii. 2.

This fish is found along the whole line of the southern coast of England, in the Bristol and St. George's Channels; and, though less numerous farther north, it has been noticed on our eastern coast by Dr. Johnson and Dr. Neill as occurring in Berwick Bay and the Frith of Forth, but it is not included in Low's *Fauna Orcadensis*. On the Irish coasts the Basse is a well-known fish, and numbers are taken in nets spread for Salmon, Sea-Trout, and Mullet. It is stated by Willughby that this fish sometimes attains the weight of fifteen pounds; Dr. Thompson saw one in Belfast Market weighing fourteen pounds; and I have been told of one that weighed twenty-eight pounds; but the more ordinary size is from twelve to eighteen inches in length, and the flesh is then excellent food. The Basse swim in sculls along the coast, depositing their spawn in summer, and generally near the mouths of rivers, up which they frequently pass to a considerable distance: they have been retained with success in Mr. Arnold's fresh-water lake in Guernsey, and Dr. M'Culloch has vouched for the superiority of the flavour obtained by the change.* Their food consists generally of living prey. Dr. Neill took from the stomach of one the fry of the Sand-Launce and two

* Erudita palata docuit (Marcius Philippus) fastidire *fluvialem Lupum*, nisi quem Tiberis adverso torrente defatigasset.—*Colum.* viii. 16.

young specimens of the Father-Lasher: and Mr. Thompson found Whitings in the stomach of one that he opened. They feed also on small crustaceous animals; and Mr. Couch, of Cornwall, states, that "this fish is particularly fond of *Onisci*, in pursuit of which it ventures among the rocks in the midst of a tempest, as at that time these insects are frequently washed from their hiding-places.* Mr. Charles Barron reports that Basse of considerable size are frequently obtained in the various "lakes" or branches of Portsmouth Harbour, being readily caught with a hand-line, in places where the bottom shelves steeply from the beach. Great quantities of the young frequent "Haslar Lake;" he supposes them to feed on an *Actinia*, which is plentiful in that recess of the harbour.

Basse are captured at sea by various means: by the trawl-net, and by hooks attached either to hand-lines or deep sea-lines. They take a bait freely; and many are caught by angling, during the flood-tide, with a long rod and strong line, from a projecting pier-head or jutting rock. "We have seen several taken in Bideford Bay," says Colonel Montagu, "with a small Seine net, manageable by two men. The men wade a considerable way into the water on this gradually-inclining sandy shore, and when the water reaches above their middle, the net is strained by the men separating, and drawn on shore, each man holding by a cord at the ends."—*Montagu's MS.*

Ovid and Pliny speak eloquently of the cunning evinced by this fish in burying itself in the sand until the net has passed over, whence they say came its name of *Lupus;* as

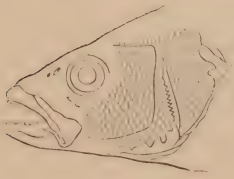
* Ælian and Oppian both refer to the *Labrax* or *Lupus* owing its death in turn to the *Oniscus*, which wounds the palate of its captor with its serrated process, producing a mortal wound.—*Vide* Opp. Halieut., ii. 128; Æl. i. c. 30.

that of *Labrax* is expressive of its voracity; παρὰ τὴν λαιμαργίαν, *Athen.* vii. 310.

D. 9—1+12: P. 16: V. 1+5: A. 3+11: C. 17. Vertebræ 25.

The position and form of the fins are shown in the wood-cut, and the character of the parts of the head in the additional outline at the bottom of this page. The body of the fish is elongated as compared with that of the Perch, and in shape resembles that of the Salmon: the teeth are uniform in size, short, and sharp, those on the tongue assisting in passing the food back towards the throat. The nostrils are double; the mucous pores numerous; the irides silvery; the back dusky blue, passing into silvery white on the belly; the scales of moderate size, adhering firmly; the fins pale brown.

At Ramsgate, and some other places along the line of the Kentish coast, the Basse is called a *Sea-duce*.



THE RUFFE, OR POPE.

Acerina vulgaris,	Cuv. et Valenc. Poiss. t. iii. p. 4, pl. 41.	
Perca cernua,	Linnæus.	Bloch, pt. ii. pl. 53.
,, ,,	*Ruffe*,	Penn. Brit. Zool. 1812, vol. iii. p. 350.
,, ,,	,,	Donov. Brit. Fish. pl. 39.
Cernua fluviatilis,	,,	Flem. Brit. An. p. 212, sp. 141.

Acerina. *Generic Characters.*—Head scaleless, with many mucigenous excavations in the cranium, five or six on the suborbitar chain, and others on the mandible. Preoperculum armed with curved points separated by sinuses, but having no fine serratures. Two anal spines. One dorsal, which sinks at the junction of the spinous and articulated portions. Teeth setaceous, crowded on the jaws and front of the vomer, a few extending to the palatines; no canines. Three pancreatic cæca. Scales ctenoid.

The Ruffe, a fresh-water fish, allied to the Perch, but with a single dorsal fin, appears to have been unknown to the ancients, and Cuvier assigns the credit of its first discovery to an Englishman whose name was Caius.* He found it in the river Yare, near Norwich, and called it *Aspredo*, a translation of our name of Ruffe (rough), which is well applied to it on account of the harsh feel of its denticulated or ctenoid scales. Caius

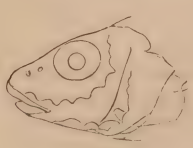
* The learned Dr. Caius, well known for his various zoological writings.

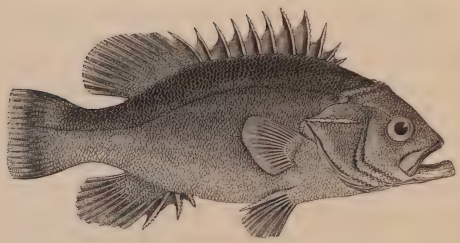
sent the first figure of this fish to Gesner, who published it.

The Ruffe is common to almost all the canals and rivers of England, particularly the Thames, the Isis, and the Cam; and, though said to be unknown in Spain, Italy, and Greece, is found over the colder portion of the European Continent, preferring slow shaded streams, and a gravelly bottom. In its habits the Ruffe resembles the Perch; and it feeds, like that fish, on the fry of others and on aquatic insects. A small red worm used as a bait, generally proves too tempting to be long resisted. Though it seldom exceeds six or seven inches in length, its flesh is considered excellent. The spawning season is in April; and the ova, which are of a yellowish white colour, are deposited among the roots and stems of flags and rushes at the sides of the stream.

D. 14+12: P. 13: V. 1+5: A. 2+5: C. 17.

The prevailing colour of the upper part of the body and head is a light olive-brown, passing into a yellowish brown on the sides, and becoming almost silvery white on the belly. The lateral line is prominent and strongly marked. A tinge of greenish pearl pervades the gill-cover: the irides are brown, the pupil blue. Small brown spots are disseminated over the back, dorsal fin, and tail, assuming on the latter the form of bars; the pectoral, ventral, and anal fins, are pale brown.





COUCH'S POLYPRION.

STONE BASSE AND WRÈCK-FISH, *Cornwall.*

Polyprion cernium,	Cuv. et Valenc. Poiss. t. iii. p. 21, pl. 42.
,, ,,	Valenc. Mém. du Mus. t. xi. p. 265, pl. 17.
Amphiprion Americanum,	Schneider, Syst. Ichth. p. 205.
,, *Australe*,	,, ,, ,, pl. 47.
Scorpæna Massiliensis,	Risso, Ichth. p. 184.
	Stone Basse, Couch, Linn. Trans. vol. xiv. p. 81.
Serranus Couchii,	*Couch's Serranus*, Brit. Fish. vol. i. p. 12, 1st ed.

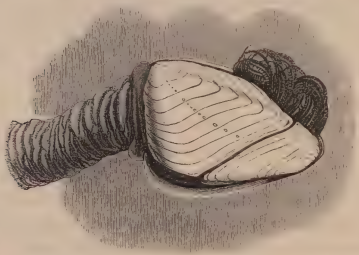
Polyprion. *Generic Characters.*—Preoperculum strongly and irregularly denticulated, its anterior border also being rough. A strong spiny crest traverses the operculum horizontally, and there is a less prominent point below it; suboperculum and interoperculum finely denticulated; serratures also on the suprascapular and coracoid, with crests and tubercles on the upper rim of the orbit, causing the head to resemble that of a Scorpæna. Teeth small, and card-like on the jaws, fore part of the vomer, and palatines, also taller and stronger on the pharyngeals and branchial rakers. Dorsal single. Stomach cæcal, obtuse; two pancreatic cæca.

In the first edition of the History of British Fishes I included the Stone Basse of Mr. Couch, of which that gentleman had favoured me with a drawing, as an undescribed species of the genus *Serranus* of Cuvier. At

that time I had not seen a specimen of the fish. The Rev. R. T. Lowe, who has devoted great attention to the fishes of Madeira, where he has resided many years, first intimated to me that this supposed new species was in fact the *Polyprion cernium* of Cuv. and Val., well known to him as being a common fish at Madeira, and which is now ascertained to range as far to the south as the Cape of Good Hope. Subsequently Mr. Lowe sent to me from Madeira a fine example of this fish, and Mr. Spence presented me with a beautifully-preserved specimen from Plymouth; and Mr. Bellamy has given me by letter a detailed account of one taken off that port. I am still, however, anxious to identify this species with the name of Mr. Couch, who first made it known as a British fish.

This species is remarkable for having escaped the notice of all the early ichthyological writers, although it is common in the Mediterranean, and attains a large size, sometimes weighing one hundred pounds, and measuring five or six feet in length. Mr. Baker, of Bridgewater, tells me that examples of this fish, of three feet in length, are not uncommon in the Bristol Channel. Mr. Couch, in reference to its habits, says, "This species approaches the Cornish coast under peculiar circumstances. When a piece of timber, covered with Barnacles, is brought by the currents from the more southern regions, which these fishes inhabit, considerable numbers of them sometimes accompany it. In the alacrity of their exertions, they pass over the wreck in pursuit of each other, and sometimes, for a short space, are left dry on the top, until a succeeding wave bears them off again. From the circumstance of their being usually found near floating wood covered with Barnacles, it might be supposed that this shell-fish forms their food; but this does not appear to be the case, since, in many that were

opened, nothing was found but small fishes. Perhaps these young fishes follow the floating wood for the sake of the insects that accompany it, and thus draw the Stone Basse after them." One of these Barnacles is here represented.



The Rev. Robert Holdsworth of Brixham, who has furnished me with many interesting notes on British Fishes, sends me word that, on the Devonshire coast, this fish is also called Stone Basse and Wreck-fish, thus illustrating the habits of the species as noticed by Mr. Couch, by a reference to the floating timbers to which the Barnacles adhere, and float along with them. Two paragraphs from Mr. Holdsworth's letter on this fish are as follows:—"October 7th, 1824. The crew of the Providence smack found a large log of mahogany in Start Bay, covered with long Barnacles, and surrounded by a shoal of these fish. They jigged,—that is, caught with a pole having a barbed hook at the end,—four or five. I had two cooked, which I purchased of the crew of the Providence, and found them excellent." Captain Nicholls, in a voyage from St. John's, Newfoundland, to the

coast of Portugal, having his ship's bottom very foul, and covered with Barnacles, was becalmed for many days within a hundred leagues of Oporto, and was for a fortnight surrounded with these fishes, which followed the ship, and were caught by the crew. He fed his men upon them for twelve or fourteen days, and considered them excellent food.

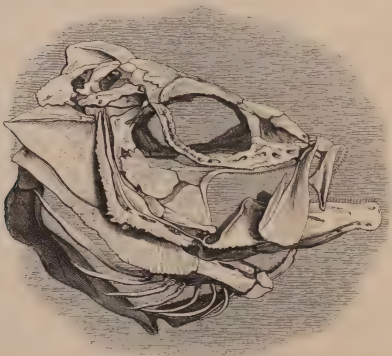
Mr. R. Q. Couch, in the Zoologist for 1846, notices this fish in terms corresponding with the above extracts, and adds that in some seasons it is by no means rare on the Cornish coast, and that it was common in the winter of 1845, between Scilly Island and the Land's End. It is often, he says, seen by the fishermen of Mount's Bay five or ten leagues from the land.

As before noticed, according to M. Valenciennes, Savigny, and Risso, this Polyprion,—the only species of the genus,—is common in the Mediterranean, where it lives throughout the year over rocky bottoms in deep water. The flesh is white, tender, and of good flavour. M. Valenciennes ascertained that it feeds on mollusks and small fishes; he also found Sardines in the stomach. The Rev. R. T. Lowe says this is one of the most common fish in the market at Madeira, where, when small, it is called *Chernotte*, and when large *Cherne*, (pronounced Shareny, by the Portuguese,) and Jew-fish by the English; and is deservedly held in esteem for the table. Its range extends to the Cape of Good Hope, and Dr. Latham states that it frequents the shores of America.

In the specimen here described, the length from the point of the upper jaw to the posterior end of the horizontal bony ridge on the operculum, is to the whole length of the fish, exclusive of the caudal rays, as one to three; the depth at the origin of the ventral and pectoral fins, is to the whole length, from the point of the lower

jaw when the mouth is open to the end of the caudal rays, also as one to three; the thickness of the fish equals half its height; the lower jaw is the longer; the nostrils are double, their openings circular; the eyes are dark brown; the ventral and pectoral fins originate under the fourth spinous ray of the dorsal fin. The upper half of the fish is of a dark purplish brown, the under part almost silvery white; the membranes connecting the various fin-rays being dark brown and the extreme margin of the tail-fin nearly white; young specimens are described and figured as marbled over with two shades of brown. The lateral line rises high over the base of the pectoral fin, afterwards following a course nearly parallel with the outline of the back. The figure given above was taken from the specimen of this fish sent to me by Mr. Lowe, which measured sixteen inches in length, and the skull is represented in the vignette. The fin-ray formula is as follows:—

D. 11+12: P. 16: V. 1+5: A. 3+9: C. 17. Vertebræ 26.



THE SMOOTH SERRANUS.

GAROUPA, *Portugal.*—GROUPER *of Seamen.*

Serranus cabrilla, Cuv. et Valenc. Poiss. t. ii. p. 223, pl. 29.
Perca cabrilla, Linnæus.
,, *channa,* Couch, Mag. Nat. Hist. vol. v. p. 19, fig. 6.

Serranus. *Generic Characters.*—Dorsal single, the spinous and articulated portions coalescent without a strong notch at their junction. Teeth setaceous, crowded on the jaws, (*velutine* or *brush-like,*) exteriorly larger, conical and curved (*canines*); interiorly, and on the chevron of the vomer and along the palatines fine and short. Gill-covers scaly, preoperculum serrated, operculum tri- or bispinous. Air-bladder large, simple. Stomach a large cæcal sac, the pyloric opening being high up.

We are indebted to Mr. Couch, of Cornwall, for the only specimens of *Serranus* known to have been taken on our coast, and which will be found to belong to two distinct species. The first is the Smooth Perch, *Perca channa,* a fish made known as frequently occurring on the coast of Cornwall by Mr. Couch, in an article in Loudon's Magazine of Natural History; which contained also a notice of a second species of the same genus, and likewise remarks on several interesting species in other genera, some of which were new.

Both Cuvier and Mr. Couch refer the fish before us to the *Channus* or *Channa* of Gesner, Ray, and Gmelin; and the peculiar habit of the Channa recorded by Gesner, and observed by Mr. Couch to prevail in his Smooth Perch,—together with the close resemblance between the descriptions by Cuvier, in the *Hist. des Poiss.* t. ii. p. 223, and that by Mr. Couch, in the Magazine before quoted —leave little doubt that the *Serranus cabrilla* of Cuvier and Valenciennes, and the *Perca channa* of Mr. Couch, are in reality the same species.*

This *Serranus* is abundant in the Mediterranean, passes pretty far northward in the ocean, and is taken in the opposite direction, as far south as Madeira and Teneriffe. Mr. Couch considers it to be a common fish, well known to the Cornish fishermen; "that it keeps in the neighbourhood of rocks not far from land;" and adds, "it is singular that the spasm, which seizes the fish when captured, never passes off: hence it is found, long after death, in a state of rigidity and contortion, with the fins preternaturally erect."

D. 10 + 14: P. 15: V. 1 + 5: A. 3 + 8: C. 17.

The peculiarities of the teeth are expressed in the generic characters; the operculum ends in a membranous tip, before which the bone emits three small, flat, spinous points; the under serratures of the preoperculum are the strongest; "the irides are yellow; the body about ten inches long, compressed, and deep. Colour of the back brown, in some specimens having distinct bars running round to the belly; sides yellow, reddish, or saffron-coloured, more faint below: two irregular whitish lines

* Linnæus, on introducing this species into his system, gave with it by mistake a description of the Bergylt (see p. 72), and Bonnaterre augmented the blunder by reproducing Pennant's figure of the Bergylt as a portrait of *Serranus cabrilla*.

pass along the side from head to tail; a third, more imperfect, runs along the belly. On the gill-plates there are several faintish blue stripes, running obliquely downward. The fins are striped longitudinally with red and yellow; and the pectorals are wholly yellow." The description is from Mr. Couch; the figure, from the work of Cuvier. One peculiarity of the *Serrani* must not be passed over. Cavolini and Cuvier have, after repeated examinations, described the Smooth Serranus, and some other species of this genus, as true hermaphrodites, one portion of each lobe of roe consisting of true ova, the other part having all the appearance of perfect milt, and both advancing to maturity simultaneously. A structure of a different kind, which must be considered as accidental, has been observed by others in the Perch, Mackerel, Carp, Cod, Whiting, and Sole. This occasional malformation, to speak in a popular phrase, consists of a lobe of hard female roe on one side, and of soft male roe on the other side, of the same fish. Observations are still wanting to prove whether such fishes have the power of impregnating their own ova. Cavolini believed that the Serrani had this power; and the probability is, that in the other cases the fish are also prolific, since the two sides are observed to be of equal growth.

Since the publication of the first edition of this work, Mr. Couch has been kind enough to send me the roes of two specimens of this Serranus. These, on examination, contained true ova only; and Mr. Owen, of the College of Surgeons, whose microscope was used on this occasion, agreed with me that although these organs were of small size, there was nothing equivocal either in the structure or appearance.

THE DUSKY SERRANUS.

Serranus gigas, Cuv. et Valenc. Poiss. t. ii. p. 270, pl. 33.
Perca robusta, Couch, Mag. Nat. Hist. vol. v. p. 21, fig. 7.
,, *gigas*, Brunnich and Gmelin.
,, ,, Jenyns, Brit. Vert. p. 333.

The second British species of Serranus was also first made known as occurring on our shores by Mr. Couch, and is his Dusky Perch, *Perca robusta*, which, from a careful comparison of descriptions, appears to be identical with the *Serranus gigas* of Cuvier and Valenciennes, above quoted, and the synonymes have been brought together accordingly.

This species belongs to the subgeneric division of the *Serrani*, named by Cuvier *Merous*, which has for a distinctive mark the presence of very small scales on the mandible. It inhabits the Mediterranean, and is also, but less frequently, taken in the Bay of Biscay. Among the islands of its more congenial sea, this fish sometimes attains the weight of sixty pounds, whence its specific name *gigas*; but specimens of ordinary occurrence weigh only from ten to twenty pounds; and the flesh is

in some estimation as food. The females deposit their spawn in shallow water during the months of April and May. In the present instance, the figure and fin-ray formula of Cuvier are given; to which the description of Mr. Couch's fish is added, the better to prove, by their general accordance, the correctness of the junction here proposed. The number of fin-rays are, according to

Cuvier. B. 7: D. 11+16: P. 17: V. 1+5: A. 3+8: C. 15.
Couch. „ 7: „ 11+17: „ 19: „ 6 : „ 2+9: „ 16.

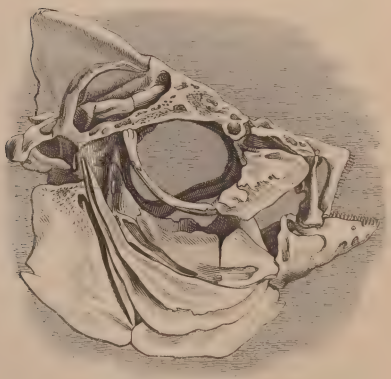
"The fish," says Mr. Couch, "from which this description was taken, weighed sixteen pounds, and measured three feet in length, and seven inches in depth, exclusive of the fins; the body is thick and solid. Under jaw longest; both jaws, as well as the palate, having numerous slender incurved teeth: in front of the under jaw was a band of them. Lips like those of the Cod-fish; two large open nasal orifices, and a large hole under the projection of the nasal bone. First plate of the gill-cover serrated, the second with a broad flat spine, projecting through the skin, and pointing backward; the fleshy covering of the gill-covers is elongated posteriorly; seven rays support the gill-membrane. Body and head covered with large scales; the lateral line gently curved. The dorsal fin single, long, expanding towards its termination; with eleven spinous rays, the first short, and seventeen soft rays, the two last springing from one origin. Pectoral fin round, of nineteen rays; ventrals of six rays, fastened down by a membrane through part of their course. Vent an inch and a half from the origin of the anal fin, which fin has two spinous and nine soft rays, the last two springing from one origin. Tail-fin roundish, of sixteen rays. Colour of the back reddish brown, lighter on the belly: two slightly-marked lines on the gill-covers running obliquely downward, one on each plate. The gill-covers are not

ridged. In its aspect this fish has some resemblance to the *Labri*, yet it has none of the generic characters by which these fishes are distinguished. I have not been able to find that it has been either figured or described, and venture to denominate it *Perca robusta*, from its great size and strength. I have never seen more than one specimen, which was taken with a line." Mr. R. Q. Couch quotes Mr. Chirgwin's authority for the capture of two individuals of this species in Mounts Bay.—*Zoologist*, 1401.

Cuvier informs us that the fishermen of Provence and Gascony call this fish *Mérou*, a term supposed to have been borrowed from the Spaniards, and to have reference to some fancied resemblance to the *Labrus merula*.

The vignette below represents the bones of the cranium as observed in the Sparidæ.

SKULL OF THE GILT-HEAD.



THE GILT-HEAD.

Chrysophrys aurata, Cuv. et Valenc. Poiss. t. vi. p. 85, pl. 145.
Aurata Rondeletii, Willughby, p. 307, tab. V. 5.
Sparus aurata, Linnæus. Bloch, pt. viii. pl. 266.
" " *Gilt-head*, Penn. Brit. Zool. iii. p. 327, but not pl. 66.

Sparidæ. *Family Characters.*—Dorsal single, the spinous part scaleless, or nearly so, falling into a furrow, and equal to or surpassing the articulated portion in extent. Pectorals and ventrals acute; caudal crescentic at the end. Maxillary gliding under the generally high præorbitar. Snout neither projecting nor the mouth conspicuously protracted. Skull not cellular, and no armature or strong serratures on the gill-covers. Scales peculiar (sparoid). No palatine teeth. Branchiostegals generally six, sometimes five, rarely seven.

Chrysophrys. *Generic Characters.*—Front teeth incisorial, several rows of rounded molars on the limbs of the jaws, which present broad surfaces within the mouth. Cheek scaly. Branchiostegals six.

The broad characters by which Cuvier grouped together the fishes of the Sparoid family were their single dorsals, acanthopterous fins, and want of spines on the head, and of teeth on the palate; to these Agassiz has added the peculiar structure of their scales. Sparoid scales are described by him as being thin, broader than long, with the centre of growth near their posterior border, and the lines of structure lying parallel to the posterior or free border, but becoming straight laterally.

The Gilt-head is one of the fishes most abundant in the Mediterranean: from Gibraltar it is found as far south as the Cape of Good Hope, and northward along the coast of Spain and France; thence to the bold parts of our southern coast,—Colonel Montagu having examined two specimens taken at Torcross in 1802; since that time, a fine specimen, measuring fifteen inches in length, has been brought to the London market, and is now carefully preserved; and another has been taken about eight inches long at the mouth of the Tweed. Dr. Fleming has recorded the capture of one specimen in the estuary of the Tay in the month of August. This fish does not appear, however, to proceed so far north as some other species of the same family, and it is not included in the *Fauna* of Fabricius or of Müller. Duhamel has remarked of the species of *Chrysophrys*, that they are averse to cold, and that numbers perished in the severe winter of 1766.

The *Chrysophrydes* were so called by the Greeks because of their golden-coloured eyebrows, from whence also the names of *aurata*, *daurade*, and Gilt-head, have arisen. They were preserved in *vivaria*, and Sergius, who was the inventor of these stews for marine fishes is said by Pliny to have acquired, from his culture of this fish, the surname of *Orata*, which descended to his posterity.

The Gilt-heads of the Lucrine Lake were in the highest esteem with the Roman epicures.

> Non omnis laudem pretiumque *Aurata* meretur,
> Sed cui solus erit concha Lucrina cibus.
>
> MARTIAL, xiii. 90.

Apicius has left a receipt for preparing a sauce, for the Gilt-head, and also for compounding a dish of Gilt-head, Four-toothed Sparus, Mullet, and Oysters. In our days the Sparoids are held to be of little value, and large

quantities, which during the short season in which they are taken, are brought by the Cornish and Devonshire fishermen to the Hampshire Markets, are sold to the poor at a low price. The largest *Daurades*, brought to Toulon and Marseilles, come from Lac Biserte, near Tunis.

Like most of the *Sparidæ*, the Gilt-heads frequent deep water on bold rocky shores, where they are occasionally caught by lines or nets. They are said to spawn in summer; and their food consists of molluscous and testaceous animals, which their rounded teeth and strong jaws enable them to break down even in such thick and hard shells as those of the genera *Turbo* and *Trochus*.

The body is deepest at the commencement of the dorsal fin: the head is short and elevated; the irides are golden yellow, the pupils black; the semilunar spot over the eye is of a brilliant golden colour; and there is a violet-coloured patch at the upper part of the edge of the operculum; the scales of the cheeks are smaller than those of the body: the teeth in an adult fish are as shown by the vignette, but in young fishes of this species they are fewer in number. The fin-rays are—

D. 11 + 13: P. 20: V. 1 + 5: A. 3 + 11: C. 17.

The back is silvery grey shaded with blue; the belly like polished steel, with longitudinal golden-coloured bands on the sides, that give them a yellow appearance: the fins are greyish blue; the tail darker: the dorsal and anal fins appear as if placed in grooves, from the rising edges of the scales on each side. This fish seldom exceeds twelve inches in length. The figures of the fish and teeth are derived from the work of Cuvier and M. Valenciennes.

THE BRAIZE, OR BECKER.

PANDORA, AND KING OF THE SEA BREAM.
PARGO, *Madeira.*

Pagrus vulgaris, Cuv. et Valenc. Poiss. t. vi. p. 142, pl. 148.
Sparus pagrus, Linnæus.
,, ,, *Becker,* Couch, Trans. Linn. Soc. vol. xiv. p. 79.
Pagrus vulgaris, Braize, Flem. Brit. An. p. 211, sp. 137.

Pagrus. *Generic Characters.*—Aspect and general structure of *Chrysophrys*, but there is a villiform band of teeth on each limb of both jaws behind the conical front ones, and two rows only of rounded molars farther back: the jaws are less thick than in *Chrysophrys*. Cheeks scaly.

There is considerable similarity in outward form between the true *Pagrus*, the subject of the present article, and *Chrysophrys*, the fish last described; but the red colour of the Braize, and the circumstance of its possessing but two rows of molar teeth, are sufficient to distinguish it. This fish was originally well-figured by Rondelet, lib. v. c. 15; yet the number of the *Pagri* in the Mediterranean of a red colour, has led to some confusion in the accounts

of many of the different authors since; neither Willughby nor Bloch can be quoted with certainty, and Pennant refers in his synonymes to both these authors, though they appear to have been considering two distinct fishes, neither of which accord with the true *Pagrus*. The name of this fish is said to be derived from *phagus, e phago*, 'to eat,' from its voracity; and its food is partly sea-weed, with shrimps and testaceous animals.* Mr. Couch says that it appears on the Cornish coast in moderately-deep water throughout the summer and autumn, but retires in winter and spring. The young are but rarely seen. In the north of Ireland a fish is taken, called the Brazier, but Mr. Thompson mentions that this name is there given to the common Sea Bream, *Pagellus centrodontus*. M. Risso says that in the Mediterranean this fish frequents deep water near rocks; and that the females are full of roe in summer.

In September 1837, the Rev. Robert Holdsworth of Brixham sent me a fine specimen of this fish, one of four brought in by the fishermen of that place. Dr. Parnell has since given me one taken also on the Devonshire coast, and has lent to me his specimen taken in the Frith of Forth. I am, therefore, enabled to give a description from British examples of the fish. The Rev. Mr. Holdsworth sends me word that this species does not appear on that coast constantly, but only at intervals, and that sometimes the fishermen do not take any for months. It is caught in deep water by hooks, which are generally baited with mussels. There is reason to believe that this is the species of Sea Bream, which in Spain, and in some parts of the Mediterranean also, is called

* Rondelet says that the Dalmatians name this fish πάγρος, the Greeks πάγγρος; in the Balearic Isles it is called *Pagara*, and in Sicily *Praù* and *Paurà*, and it is most probably the *Pagur* of Ovid, Halieut. v. 108.

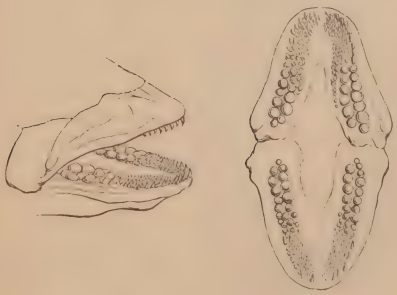
Pandora, by which name it is known at Brixham, where it is also designated King of the Bream, and sells for half as much more as the Common Sea Bream, *Pagellus centrodontus*. The *Pagellus erythrinus* of Dr. Parnell's Essay is our present species the *Pagrus vulgaris*.

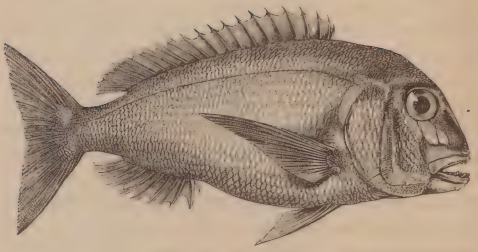
In the Brixham specimen, which is twenty-one inches long, the depth of the body at the commencement of the dorsal fin is about one-third of the whole length of the fish; the head measures six inches from the point of either jaw to the posterior edge of the operculum, or, compared to the whole length of the fish, as one to three and a half; the diameter of the orbit of the eye equals the breadth of the operculum: the preorbital bone is high; the teeth are of three sorts, as shown in the side and front view forming the vignette, the anterior row being elongated and conical, and the four immediately in front of both jaws being rather the longest. The preorbital bone and preoperculum have shining metallic-like surfaces, striated along the margin; and the scaly operculum is smooth at the edge. The dorsal fin commences over the origin of the pectoral fin, and ends rather sooner than the anal, its first twelve rays are spinous, the rest flexible; the base of the fin is lodged in a groove which is scaly on the outside: the fourth or fifth ray of the very long pectoral fin is the longest, and reaches beyond the vent; the ventral fin arises about half an inch behind the origin of the pectoral fin, is only about half as long as that fin, and has its single spinous ray shorter than the first flexible ray; the anal fin commences under the second soft ray of the dorsal fin, the first of its three spinous rays is only half the length of the second one, and the base of the whole fin is lodged in a groove formed by the free edges of the scales; the tail is forked, the longest rays of the lobes being more than as long again as the

shortest or middle rays; the lateral line, commencing at the upper angle of the operculum, ascends a little, and then runs parallel to the profile of the back; the scales on the body are large, and finely ciliated on their free margins. Mr. Holdsworth says, that the colours of this fish when just taken from the water are very beautiful: above the lateral line it is of a bluish silvery colour, below the line bright silver, with the belly and lower fins tinged with vermilion; the dorsal and caudal fins are rose-red; the irides gold-yellow, the space between the eyes reddish-brown, and there is a spot of the same colour over the commencement of the lateral line, and under the base of the pectoral fin, but these spots are not always very obvious.

D. 12+10: P. 15: V. 1+5: A. 3+9: C. 17.

DENTITION OF THE BECKER.





COUCH'S SEA-BREAM.

Pagrus orphus, Le Pagre Orphe, Cuv. et Valenc. vi. p. 150, pl. 149.
"*Aurata orphus*" ,, ,, Risso, 2e edit. p. 356.
Couch's Sea-Bream, ,, Couch. (Ion.) Zool. for 1843, p. 81.
Pagellus Rondeletii, ,, Couch. (R.Q.) Zool. for 1846, p. 1406.

Only one example of this fish is known to have been captured on the English coast, and, as is the case with several other occasional or rare visitants of the Cornish shores, we owe its enrolment in the list of British Fishes to the acuteness and active zeal of Jonathan Couch, Esq. The specimen figured above was taken on the 8th of November 1842 with a baited hook, at a rocky place termed the Edges, three miles south of Polperro. Its weight was six pounds. Mr. Couch having presented the specimen to the British Museum, Dr. Gray, Keeper of the Zoological Department of that Institution, has most kindly furnished the following account of it:—

"The specimen is stuffed. The front teeth above and below are four on each side, the upper ones being conical, the lower ones clongato-conical, and set widely apart. Behind these, but in the front part of both jaws, there is a crowded patch of small subulate teeth. On the limbs

of the jaws the molars are large with globular crowns, and rounded teeth of unequal size cover the roof of the mouth. The fish is moderately like fig. 149, in the *Histoire des Poissons*, but that figure does not show space enough between the tall conical teeth in front of the mandible, and the flat molars on the limb of the bone. The specimen also has a higher front than the figure referred to, with more resemblance in profile to *Pagellus calamus*, fig. 152, of the same work. This elevation of the face may be owing to age, for the specimen figured in the *Histoire des Poissons* was only eight inches long, while the one in the British Museum measures above twenty. (For a side view of the mouth see ii. p. 164.)

D. 12+11: A. 3+9: V. 1+5: P. 15: C. 29.

The last two rays of the dorsal and anal are contiguous at the base, and the last ventral ray is also divided to the bottom." — *Gray.*

TEETH OF COUCH'S SEA-BREAM.

Mr. Couch says, that the body is not unlike the *Pagellus centrodontus*, but is rather deeper and more stout. The head is thick, and the snout remarkably so. The back rises high above the head. The colour of the front and top of the head was a brownish-red, that of the back and fins between lake and vermilion, or like the Becker, except the anal, which was pale-yellow: the sides being pale-red and the belly whitish.—*Couch.*

THE SPANISH SEA BREAM.

Pagellus erythrinus,	Cuv. et Valenc. Poiss. t. iv. p. 169, pl. 150.
Sparus ,,	Linnæus.
Erythrinus Rondeletii,	Willughby, p. 311, tab. V. 6.
,, ,,	*Spanish Bream*, Couch, Mag. Nat. Hist. v. p. 17, f. 3.
,, ,,	*Red Sea Bream*, Wallcott's MS.
Sparus erythrinus,	*Spanish Sea Bream*, Jenyns, Brit. Vert. p. 355.

Generic Characters.—The teeth in front conical, slender, numerous, crowded; the molars rounded, small, in two or more rows, those of the outer rank the most powerful; in other respects resembling the genera *Chrysophrys* and *Pagrus*.

The *Pagellus erythrinus* of Cuvier and M. Valenciennes, the Spanish Bream of Mr. Couch, was well known to Rondelet and Salvian, is a common fish in the Mediterranean Sea, and, when issuing thence, appears to pursue a north and north-west course.

This species, Mr. Couch says, "is known to our fishermen by the name of Spanish Bream. It is rare, as I have not seen above two or three specimens, which were taken with Sea-Bream, and with the same kind of baits. Its habits seem to be like those of the Sea-Bream."

To this may be added, that the food of this species consists of small fishes and testaceous mollusks. It swims in small sculls; visiting the shore in spring, and remaining till autumn. Neither Pennant nor Donovan have included the Spanish Bream in their accounts of British Fishes; but Mr. Wallcott appears to have met with it at Teignmouth, and his drawings contain a most accurate representation of the fish.

The figure at the head of the article is from the work of Cuvier and M. Valenciennes. I should have availed myself of the drawing by Mr. Wallcott, taken from an English specimen, but the wood-block had been engraved when his MS. and its illustrations came into my hands.

Since the publication of this species in the first edition of the British Fishes, I have received two specimens from Mr. Couch, and two from Dr. Parnell, one taken on the Devonshire coast, and the other in a salmon-net near Musselburgh, where a second specimen was also taken. Mr. Thompson quotes an instance of its capture on the south-west coast of Ireland by William Andrews, Esq., as mentioned in the proceedings of the Dublin Natural History Society. This fish, except in size, bears considerable resemblance to the *Pagrus*, last described, but the small card-like teeth want the exterior row of elongated conical ones which exists in *Pagrus*. The teeth, as represented in the subjoined vignette, were drawn from the most perfect of the four specimens now before me. The largest specimen measures fourteen inches in length; the eye is larger in proportion than in *Pagrus*, the diameter of the orbit being greater than the breadth of the operculum; the preorbital bone and the preoperculum are silvery, both granulated on the superior part, and striated on the inferior; the larger and older the fish, the more metallic is the lustre: the first three or four soft rays of

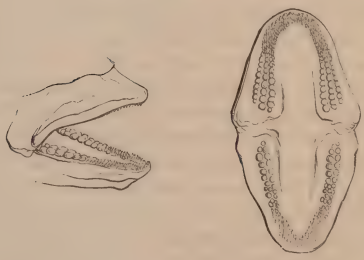
the dorsal fin are longer than the last spiny ray, and the last two or three soft rays of both dorsal and anal fin are included in a scaly covering; both fins stand in deep grooves; the caudal is slender and deeply forked.

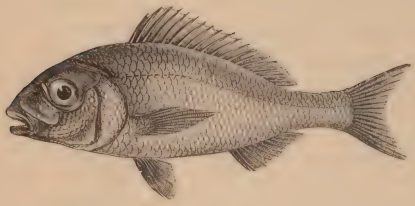
D. 12+10: P. 15: V. 1+5: A. 3+8: C. 17.

The scales of the body are large and ciliated at their free margin; the lateral line curves rather less than the dorsal profile.

The colour of this fish when alive is a fine carmine red on the back, passing into rose-colour on the sides, and becoming almost silvery white on the belly; the fin membranes are rose-colour, the anal and ventrals being paler than the others; the space between the eyes is reddish-brown, with two dark streaks of the same colour on each side of the nape, and an indication of a pale brown spot in the axilla of the pectoral fin, but this mark is most conspicuous in the larger and older specimens.

TEETH OF THE SPANISH SEA BREAM.





THE AXILLARY BREAM.

BEZUGO, *Madeira.*

Acarnane, RONDELET, Latin Edit. 1554, p. 151.
Acarne, ,, French Edit. 1558, p. 134.
Pagellus acarne, CUVIER et VALENC. Poiss. t. vi. p. 191.
,, ,, *Axillary Bream*, PARNELL, Wern. Mem. vol. vii. p. 204.

DR. PARNELL obtained examples of this Sea Bream both in the Frith of Forth, and on the coast of Devonshire; and Mr. Couch sent me one or two examples from Cornwall. It is at once distinguished from *Pagellus erythrinus*, last described, by the large comparative size of the head, and the more rounded form of the descending frontal outline. As far as my experience extends, *P. erythrinus* is the more rare fish of the two. Rondelet's figures of these two species are very characteristic. The Axillary Bream is well known in various parts of the Mediterranean.

The following is abridged from Dr. Parnell's detailed description of a fresh specimen:—"Body oval; length thirteen inches; depth four inches; sides compressed;

scales large and ciliated. General form resembling that of the Sea Bream. Dorsal profile rounded, descending obliquely from the nape to the nostrils, from thence more suddenly to the lips. Colour of the body pale silvery red; dorsal and caudal fins rose-red; ventral and anal fins paler; space between the eyes reddish-brown; in front of the eyes, and on the lower half of the preoperculum, metallic grey; at the upper part of the base of the pectorals there is a dark violet-coloured spot, very conspicuous even in the dried fish. Eye large, placed half-way between the tip of the upper jaw and the posterior margin of the operculum, its diameter being one-fourth of the length of the head. Operculum and preoperculum entire. Lateral line following the dorsal profile, composed of seventy scales. Dorsal fin commencing over the posterior margin of the operculum, and ending opposite to the last ray of the anal fin; the first dorsal spine short, about half the length of the second; the jointed rays a little longer than the terminating spiny rays. Anal fin commencing under the third jointed ray of the dorsal; the first three rays spiny, the rest soft. Pectorals and ventrals commencing on the same line. Tail forked. Jaws nearly of equal length, the under one rather the shortest; anterior teeth small and numerous, disposed in many rows; the outer row composed of thirty teeth, longer and more bent than those within; molars large, disposed in three rows on each jaw. The intervening membranes at the base of the caudal, and the last two rays of the dorsal and anal fins, covered with small thin scales, diminishing in size as they approach the summit of the rays."—*Parnell.* Number of fin-rays:—

D. 12+11: P. 16: V. 1+5: A. 3+10: C. 17.

THE COMMON SEA BREAM.

THE SHARP-TOOTHED SEA BREAM.

Pagellus centrodontus, Cuvier et Valenc. Poiss. t. vi. p. 180.
,, ,, *Red Gilt Head*, Penn. Brit. Zool. vol. iii. p. 329.
,, ,, *Lunulated Gilt-head*, Id. pl. 66.
,, ,, *Lunulated Gilt-head*, Donov. Brit. Fish. pl. 89.
,, ,, *Sea Bream* of Couch and Montagu.

The Sea Bream is a common fish in the Mediterranean, and in the ocean is taken frequently at Brest, Dieppe, and Boulogne: it is by no means an uncommon fish on the line of the southern shore of England, particularly on the coast of Sussex, and is constantly to be seen during summer and autumn in the fish-market at Hastings. Colonel Montagu obtained it in Devonshire; Mr. Couch says that it is abundant in Cornwall; and it is common all round the Irish coast.

At Antrim it is called *Murranoe* and *Barwin*, and on the north-west coast *Gunner*. To these local names Mr. Thompson adds, *Carf*, *Carp*, and *Sea-Bream*, as its north-

eastern Irish appellations, and *Brazier* as the one by which it is known in the north. On the east coast of England it is not uncommon: Dr. Johnston has met with it in Berwick Bay, and Dr. Parnell has obtained it in the Frith of Forth. It is included by S. Nilsson in his *Prodromus Ichthyologiæ Scandinavicæ;* and Professor Reinhardt has ascertained its most northern locality on the coast of Denmark: but it is not included by Linnæus in his *Fauna Suecica*, nor is it mentioned by Müller or Fabricius. The Rev. R. T. Lowe states its Madeira name to be *Goraz*.

"Common as this fish is," says Mr. Couch, "I have found a difficulty in assigning to it its proper synonymes. I suppose it, however, to be the Lunulated Gilt-head of Pennant, with his figure of which it agrees, though not with his description. Dr. Fleming's description corresponds with Pennant's; and Ray says it weighs ten pounds; but our fish would be thought enormous if of half that size. The young fish, which are commonly known by the name of Chads, are without the lateral spot until their first autumn, when they are about half-grown.

"The Sea Bream is found on the west coast of England throughout the year, but is most abundant in summer and autumn; and it retreats altogether in severely cold weather. The spawn is shed in the beginning of winter in deep water; and in January the Chads, about an inch in length, are found in the stomachs of large fishes, taken at two or three leagues from land: in summer, when from four to six inches long, they abound in innumerable multitudes, and are taken by anglers in harbours, and from projecting rocks; for they bite with great eagerness at any bait, even of the flesh of their own species. The food, both of the young and

adult fish, is not, however, confined to animal substances, for they devour the green sea-weeds, for bruising which their teeth are well suited, as their long and capacious intestines are for digesting. In its general habits, the Sea Bream might be considered a solitary fish; yet the fishermen inform me of instances in which multitudes are seen congregated at the surface, moving slowly along as if engaged in some important expedition. This happens most frequently over rocky ground in deep water. The Sea Bream is not highly esteemed for the table, and is not at all in request when salted: hence, when abundant, I have known it sold at so low a rate as two shillings and sixpence the hundredweight!"—*Couch.*

In the stomach of one that was examined by Colonel Montagu, were several small Sand Launce, limbs of crustaceous animals, and fragments of shells.

The *Pagellus curtus* of Mr. Couch (Zoologist for 1843, p. 304, with a figure) is most probably merely a variety of *P. centrodontus.*

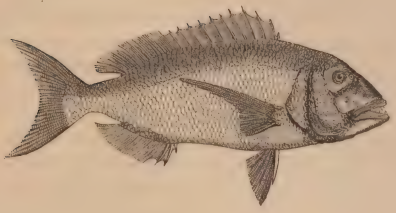
When at the sea-coast on fishing excursions, it has been one of my customs to eat of the various fishes I could procure that are not in general use for the table. With the example of Isaac Walton before me, I will venture to suggest a mode of preparing a Sea Bream which materially improves its more ordinary flavour. When thoroughly cleaned, the fish should be wiped dry, but none of the scales should be taken off. In this state it should be broiled, turning it often, and if the skin cracks, flouring it a little to keep the outer case entire. When on table, the skin and scales turn off without difficulty; and the muscle beneath, saturated with its own natural juices, which have been retained by the outside covering, will be found of good flavour.

The jaws are short and equal in length, and armed with

teeth as shown in the vignette below: the eye very large, irides golden yellow: the head short, the profile exhibits a shelving curve from the dorsal fin, more rapid before the eye: the cheeks, operculum, and interoperculum are covered with scales; the preoperculum, and part of the space before and under the orbit, have a tinfoil appearance: two narrow stripes on each side behind the head, meet on the central line at the top; at the origin of the lateral line, behind the edge of the operculum, there is a conspicuous dark patch made up of small spots: the colour of the body is reddish, tinged with grey; lighter on the sides, which are golden grey, and marked with faint longitudinal bands the whole length of the body: the belly is nearly white; the dorsal and anal fins are brown, each lodged in a groove; the pectorals and caudal are red; the ventrals grey.

D. 12+13: P. 17: V. 1+5: A. 3+12: C. 17.

TEETH OF THE COMMON SEA BREAM.



THE SPARUS, OR DENTEX.

Dentex vulgaris, Cuvier et Valenc. Poiss. t. vi. p. 220, pl. 153.
,, *Bellonii*, Willughby, p. 312, tab. V. 3.
Sparus dentex, Linnæus. Bloch, pt. viii. pl. 268.
,, ,, *Toothed Gilt-head*, Penn. Brit. Zool. vol. iii. p. 331, but not the plate bearing that name, which represents Ray's Bream.
,, ,, *Four-toothed Sparus*, Donov. Brit. Fish. pl. 73.
,, ,, *Johnsoni*, Wall. Artedi, vol. iv. p. 302.
Dentex vulgaris, Flem. Brit. An. p. 212, sp. 139.

Dentex *vel* Sparus. *Generic Characters.*—Teeth subulate, crowded, unequal, with at least four on each jaw, taller, stouter, and curved (canines). Cheek scaly. No pores on the mandible. Vertebræ 23; air-bladder simple, with thick coats. In other respects having the usual Sparoid aspect—a large and high head, without scales on the preobitar, forehead, or preoperculum, pointed pectorals, and the dorsal and anal moving in furrows. Branchiostegals six.

The Four-toothed Sparus is here inserted as a British species on the authority of Donovan, the only English naturalist I am aware of who has recorded its capture on the British coast. In April 1805, a specimen of this fish, two feet six inches in length, which had been caught off Hastings, was brought to the London market, and, fortunately, fell into the hands of the author of the

Natural History of British Fishes, who has given a good representation of it in his work.

As a Mediterranean species it is exceedingly well known; and there is little doubt this fish was the *Dentex* of the Romans. It is remarkable for the great length of four anterior teeth in each jaw; and a second species of the same genus, as now restricted—also a native of the Mediterranean—was from this peculiar character called *Cynodon* (Dog's-tooth). The Four-toothed Sparus acquires a large size, sometimes three feet in length, and from twenty to thirty pounds of weight: Duhamel, on the authority of Gortier, mentions one instance of a *Dentex* that weighed no less than seventy pounds. They appear to be much more rare in the ocean, as well as smaller in size.

The fish recorded by Mr. Donovan weighed sixteen pounds. "A more voracious fish," says that writer, "is scarcely known; and when we consider its ferocious inclination, and the strength of its formidable canine teeth, we must be fully sensible of the great ability it possesses of attacking with advantage fishes, even of superior size. It is asserted, that when taken in the fishermen's nets, it will seize upon the other fishes included with it, and mangle them dreadfully. Being a swift swimmer, it finds abundant prey, and soon attains to a considerable size. Willughby observes, that small fishes of this species are rarely taken; and the same circumstance has been mentioned by later writers. During the winter it prefers deep waters; but in the spring, or about May, it quits this retreat, and approaches the entrance of great rivers, where it deposits its spawn between the crevices of stones and rocks.

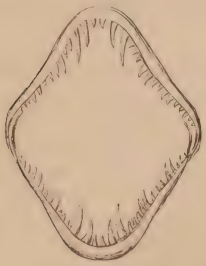
"The fisheries for this kind of Sparus are carried on upon an extensive scale in the warmer parts of Europe.

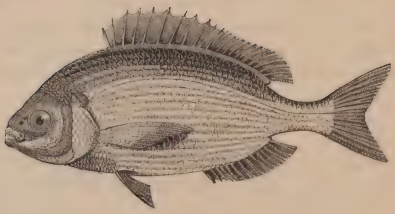
In the estuaries of Dalmatia and the Levant, its capture is an object of material consideration, both to the inhabitants generally as a wholesome and palatable food when fresh, and to the mercantile interests of those countries as an article of commerce. The fish is prepared according to ancient custom, by cutting it in pieces, and packing it in barrels with vinegar and spices."—*Donovan.*

D. 11+11: P. 14: V. 1+5: A. 3+7: C. 17.—*Cuvier.*

The head is obtuse; the eyes are rather small, the irides yellow; the back is of a brownish-red, slightly mottled with some darker spots; the sides paler, and inclining to yellow; the belly almost white. This fish is said to become of a greenish-purple tint by age, and to be paler in colour during winter. The lateral line takes the curve of the back, throughout its whole length, and keeping at about one-fourth of the depth of the fish. All the fins are pale reddish-brown.

TEETH OF DENTEX OR SPARUS, FROM BLOCH.





THE BLACK SEA BREAM.

CHOUPA, *Madeira.*

Cantharus griseus,	Cuvier et Valenc.	Poiss. t. vi. p. 333.
Sparus lineatus,	*Black Bream,*	Montagu, M. Wern. Soc. ii. pl. 23.
,, *vetula,*	*Old Wife,*	Couch, T. Linn. Soc. xiv. p. 79.
Pagrus lineatus,	Flem. Brit. An. p. 211, sp. 138.	
Cantharus griseus,	*Black Sea Bream,*	Jenyns, Brit. Vert. p. 358.

Cantharus. *Generic Characters.*—Teeth densely crowded and card-like, of equal height, except the exterior row, which consists of teeth equally crowded, but somewhat stouter and more curved than the others. Branchiostegals six. Cheek scaly. Scales and general aspect Sparoid. Air-bladder large and simple.

The Black Bream, the *Cantharus griseus* of Cuvier and M. Valenciennes, was made known as a British fish in 1815, by Colonel Montagu, under the name of *Sparus lineatus;* and in 1822, Mr. Couch included in his paper printed in the Transactions of the Linnean Society, a notice of a fish under the name of *Sparus vetula* which he has since stated he considers to be identical with the *Sparus lineatus* of Montagu. Cuvier does not appear to have been aware of the description and figure of this fish in the Memoirs of the Wernerian Natural History

Society, since, in 1830, in the sixth volume of the *Histoire Naturelle des Poissons*, he states, at page 319, that his fourth species, *C. griseus*, then appears for the first time; but it had been also figured by Duhamel, under the name of *Sarde grise*.

The Black Bream,—for by this name is this species known along the Kentish and Sussex coasts, as well as in Devonshire,—though more rare than the Sea Bream, *Pagellus centrodontus*, is not an uncommon species. The Zoological Society has received specimens from Madeira, sent by the Rev. R. T. Lowe. It it taken at Dieppe, Boulogne, and Calais; I have seen it at Dover and Hastings. Colonel Montagu saw it in considerable abundance on the coast in Devonshire, Mr. Couch in Cornwall, and Dr. Drummond has described in Thompson's Natural History a specimen that was taken in Belfast Bay. It is taken by the hook, and also by the net: is most abundant in July and August, but is not observed to grow so large as the Sea Bream. Mr. Couch says, "It takes the common baits which fishermen employ for other fish; but feeds much on marine vegetables, upon which it becomes exceedingly fat." It enters harbours, and is frequently taken by anglers from rocks and pier-heads; but he has never known it assemble in sculls, and it is very rare to take the young of small size. Of three examples obtained by myself in the London market, the largest measures seventeen inches in length, and five inches and a half in depth, exclusive of the dorsal fin. The largest specimen recorded measured twenty inches in length.

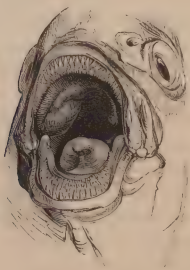
The fin-rays are,—

D. 11+12: P. 16: V. 1+5: A. 3+10: C. 17.

From the upper and back part of the head two dark lines descend to the upper edge of the operculum, enclosing between them a space covered with scales; the preoper-

culum, suborbital ring, nose, and the part over the eye, are smooth; the cheeks, operculum, and interoperculum, are covered with scales; the irides are reddish-orange; the lips and region of the mouth pale reddish-brown: the prevailing colour of the body is bluish-grey, marked with alternate dark and light narrow longitudinal bands, the centres of the scales being darker than the edges; the lateral line is darkest of all, and recedes from the dorsal profile as it approaches the top of the operculum; the dorsal fin pale brown, and lodged in a groove throughout its whole length: the pectoral fins in colour resemble the body, as do also the rays of the ventral, anal, and caudal fins; but the membranes of these fins are much darker, approaching to dusky lead-colour.

The vignette of the teeth was drawn from the large specimen of seventeen inches before mentioned as obtained in the London market.



THE BOGUE.

BOGA, *Provence.* *Madeira.*—BOBBA, *Venice.*—UOPPA, *Messina.*—BALAIJOLA, *Catania.*

Box vulgaris, *Le Bogue commun*, CUVIER et VALENC. vi. p. 348, pl. 161.
Box vel Boops, ,, ,, BELON. de Aq. p. 230.
,, ,, ,, ,, RONDELET, Pisc. p. 136.
Boops Rondeletii primus, WILLUGHBY, 317, t. U. 8, f. 1.
Box vulgaris, *Common Bogue*, YARRELL, Zool. for 1843, p. 85.

BOX or BOOPS. *Generic Character.*—Body elongated, rounded, the dorsal and ventral profiles alike, and the general aspect peculiarly trim. Mouth small; premaxillary very little movable, overlapped together with the maxillary and edge of the mandible by the preorbitar when the mouth is shut. Teeth uniserial, incisorial, chisel-shaped, lobed, and crenated. Stomach very small, with a long pyloric branch, and about five pancreatic cæca. Air-bladder large, thin, and nacry, with two long, posterior, horn-like appendages, which enter among the muscles of the tail.

THE BOGUE, or BOGA, abounds in the Mediterranean, and as it has an Atlantic range southwards to Madeira and the Canaries, and according to Cornide, northwards to the coasts of Galicia, it is precisely one of the fish that might be expected to pay occasional visits to the southern extremity of England, but Alfred Fox, Esq., of Falmouth, is the only person who as yet has had the fortune

to recognise and secure an English example of the species. That specimen was caught at St. Mawes, in a ground seine, early in October 1843, and deposited by Mr. Fox in the Museum at Truro, where it is preserved, stuffed, and varnished. Through the kindness of Dr. Barham, Senior Physician of the Cornwall Infirmary, the specimen has been lent that the subjoined description might be taken of it, but the figure on the preceding page is copied from one in the *Histoire des Poissons*, which was drawn from a fresh specimen, rather than from the Truro one, which has suffered mutilation in the fin-rays.

The genera *Box*, *Oblata*, *Boxaodon* (Guich.), *Scatharus*, and *Crenidens*, form the fourth Sparoid tribe of Cuvier, and are characterized by simple, lobed or serrated, trenchant teeth set closely side by side on the edges of the jaws; sometimes with villiform teeth behind them, or more often with many-crowded rows of minute teeth having a villiform appearance to the naked eye, but being in fact similar in form to the large incisorial ones that constitute the exterior row, and destined to succeed them as they wear away and drop out. In this tribe there are no rounded molars on the limbs of the jaws, which, consequently, are neither so strong nor so thick as in the members of the first tribe, which have broad molars, that necessarily require space. In accordance with the dentition the mouth of *Box* and its allies is small, and the neat head is very unlike that of the bull-headed *Chrysophrydes* and *Pagri*.

The Bogue, according to the *Histoire des Poissons*, spawns twice in the year, and at these times it approaches the shore in large sculls. The fishermen of Provence and Nice take it in nets of a peculiar kind, named by them *bughiera*, and to render the fishery more prosperous, they adorn their boats with small figures of the Bogue cut

in silver. Rondelet says that the flesh of the Bogue is easily digested, and on that account is a wholesome aliment for invalids, but Cornide, who speaks of it as he observed it on the Atlantic coasts of Spain, states that it has a disagreeable taste, and is consumed chiefly by poor people. Mr. Lowe tells us that it is exceedingly common at Madeira, and though he says nothing of its qualities as an article of food, he remarks of another species of the same genus that it is one of the handsomest and most worthless of fishes.

The Bogue has an elegant, moderately-compressed, elliptical form, the curves of the dorsal and ventral profiles meeting at the terminal mouth which is slightly obtuse. The greatest height of the body is at the fifth or sixth dorsal spinous ray, and is contained thrice and one-half times in the length, excluding the caudal fin. The head makes a fourth of the same distance, or a fifth of the entire length of the fish, including the caudal fin. The face forms part of the general dorsal curve without inequalities, and the crown of the head is moderately rounded transversely, the width at the posterior angles of the orbits being a little more than a diameter of the eye, but at the anterior angles a little less. The nostrils are small pore-like openings in a membrane near the anterior angle of the orbit, and close to the upper end of the preorbitar.

The mouth is very small, and is armed above and below with a single close-set series of incisorial teeth, which are channelled in front, bevelled and crenated on the edges. The minute crenatures of each of the upper teeth number about seven or eight, the cutting edges being otherwise nearly straight; but the lower teeth have a convexly-curved edge, and from the depth of the lateral crenatures are more or less lobed; in the St. Mawes specimen none of the under teeth have the

strongly-projecting middle lobe represented in the *Histoire des Poissons*, and if it existed in the younger fish it has worn down in the older specimen before us. Cuvier enumerates twenty-four teeth in the upper jaw, but the jaws being only half open in the example we are describing, we cannot reckon beyond nine or ten on each premaxillary or limb of the mandible.

The preorbitar is highest anteriorly, and narrows gradually towards its termination under the centre of the pupil, its length being about twice its greatest height; the rest of the suborbitar chain is narrow, the whole forming a half circle close beneath the eye, with a silvery lustre and many pores. The mandible has the same kind of porous nacry surface on its under aspect, and all the naked parts of the head seem to be copiously mucigenous. The upper edges of the mandible, as far back as the articulation of the jaw, are received under the preorbitars, which also wholly cover the maxillaries and all the lateral portions of the premaxillaries. A crescentic band of scales, five deep in the centre of the crescent, covers the cheek entirely between the suborbitar chain and the naked preopercular disk, which has a perfectly even hyperbolically-curved edge.

Four rows of smaller scales cover the interoperculum, which when the jaws are closed touches its fellow, and conceals the branchiostegous membrane. The posterior margin of the gill-cover is a small segment of a circle, of which the suboperculum constitutes about two-thirds. A small shallow obtuse notch with rounded corners terminates the bony edge of the operculum, above the level of the pectoral fin: with the lower corner of the notch the point of the suboperculum coincides exactly so that there is no projection, and neither bone nor notch would be perceptible in a recent specimen. The membranous

edge of the gill-cover is very narrow, and the disk is covered with six rows of scales nearly as large as those on the body, but diminishing to five and four rows as they descend over the suboperculum whose junction with the operculum they wholly conceal. From opposite the upper corner of the opercular notch, a strip of scaleless very porous integument curves upwards and forwards to the mesial line of the occiput opposite the posterior angles of the orbits where it meets its fellow: it includes the porous disk of the suprascapula, which looks like a scale, and is bounded posteriorly by eight or nine scales, being the commencement of those on the body, but appearing larger from their whole disks being exposed. On the temples between the naked border of the orbit, and the humero-nuchal arc of integument, there is a short isolated patch of scales ranged in four rows. With this exception, the top of the head, the snout and jaws, are destitute of scales.

The lateral line bounds the upper fourth part of the height, having a rather flatter curve than the back; it is composed of seventy-eight scales, exclusive of the small scales on the base of the caudal, where the line cannot be traced in the dried specimen. Where the body is highest there are six rows of scales above the row which forms the lateral line, and about twelve below, all ranged so as to form nearly a semicircular curve between the dorsal and ventral profiles, and having a Sciænoid aspect, with more or less obliquity. The free border has a smooth nacry surface with many little pits, producing the same appearance of frosted silver which the naked parts of the head exhibit. A detached scale has a straight base impressed with six, eight, ten or more furrows, separated by ridges that diverge like the rays of a fan, from a point situated in the posterior third of the disk: the sides are

also straight, and the free margin is curved, and smooth when its nacry epidermis is entire; but the adjoining half of the disk is composed of microscopical polygonal areas, like denticles worn down, and the exterior row of these denticulate the margin when the epidermis is removed: the lines of structure run parallel to the free edge and sides bending at the angles to do so.

(D. 14+15: A. 3+16: P. 18: V. 1+5: C. 15$\frac{1}{2}$.—*Hist. des Poiss.*)

The coloured drawing of the British specimen sent by Mr. Fox to Mr. Yarrell is not among the papers handed to the Editor of the present edition of British Fishes, but the following tints are enumerated by Cuvier, who describes a fresh specimen. "The back is yellowish-olive, and the belly silvery. Three or four bright golden lines traverse the sides." Even in the dried specimen the course of these lines can be traced.

The total length of the specimen is about ten inches.

JAWS OF COUCH'S SEA-BREAM (page 144).

RAY'S SEA BREAM.

Brama Raii, Cuv. et Valenc. Hist. Nat. des Poiss. t. vii. p. 281, pl. 190.
,, ,, Willughby, Appendix, p. 17, tab. V. 12. Bloch, 273.
Sparus ,, *Rayan Gilt-head*, Penn. Brit. Zool. iii. p. 330, pl. 54, named *Toothed Gilt-head*.
,, ,, *Ray's Toothed Gilt-head*, Donov. Brit. Fish. pl. 131.
Brama ,, ,, *Sea Bream*, Jenyns, Brit. Vert. p. 359.

Chætodontidæ, or Squamipennes. *Family Characters.*—Greatly-compressed, high-bodied, scaly fishes, with the articulated portions of the dorsal and anal, and frequently the spines, so enveloped in scales that the fins graduate insensibly into the thickness of the body. Scales strongly ctenoid. Intestines long; pyloric cæca numerous. Very commonly the mesial cranial crest is much elevated, in conformity with the external shape, and in some it swells out thickly, or there are some other remarkable peculiarities of the skeleton.

Brama. *Generic Characters.*—Vertical fins densely scaly; the articulated part of the dorsal extending far towards the caudal, and similar to the anal; both being higher in front, wherein a few spinous rays are buried. Compressed head and body ovate, tapering into a slender tail between the three vertical fins. Snout very short, forming part of the bold curve of the profile. Mouth nearly vertical when closed. Teeth card-like on the jaws and palatines. Branchiostegals seven. Stomach short. Pancreatic cæca five.

The very peculiarly-formed Marine Bream to which

Ichthyologists have assigned the name of our celebrated countryman, the naturalist John Ray, appears to have been less perfectly known to the older writers than might have been expected from its singular shape and prevailing numbers. It is figured by Duhamel, and also by Willughby and Bloch. Duhamel obtained his specimen from Provence, and the species is said to be common in the Mediterranean. Willughby has given a figure of this fish, tab. V. 12, which he calls *Brama marina caudâ forcipatâ;* and it is described in the Appendix to his Natural History of Fishes, page 17, from a specimen obtained, on the 18th of September, 1681, in Middlesburgh Marsh, near the mouth of the Tees, where it was left on the sands by the retiring tide. Bloch has figured and described it, as quoted in the synonymes at the head of this subject. The genus *Brama* belongs to a tribe of *Chætodontidæ*, which are characterized by having villiform or card-like teeth on the jaws and palatines. Prince Charles Bonaparte includes it in his sub-family of *Pimelepterini*, and others have considered it to be the type of a peculiar family which they term *Bramædæ*.

This fish cannot certainly be so rare or so little known generally as various authors have stated. Colonel Montagu has recorded one example taken in Devonshire, and another at Swansea: Mr. Couch obtained one or two, if not more, in Cornwall; and Mr. R. Q. Couch mentions the capture of one at the Runnel Stone. It has been taken on the Irish coast at Tramore, as mentioned in Thompson's Natural History; and a correspondent in Mr. Loudon's Magazine of Natural History, vol. vi. p. 529, says that this fish is not uncommon on the west coast of Scotland: he had himself seen several individuals from the Frith of Clyde and from the Argyleshire coast.

I may farther state, that there are two specimens in the

British Museum, one in the collection of the Zoological Society, and probably others in London. In 1828, a specimen was taken on the coast of Normandy; another at Stockton-upon-Tees in 1821—the spot of its first recorded occurrence in England in 1681; it has been taken in Berwick Bay, and Mr. Neill has recorded that several have been taken in the Frith of Forth; it has also been taken at St. Andrew's. In the autumn of 1834, I saw no less than nine examples of *Brama Raii* in the museums of Edinburgh, Newcastle-upon-Tyne, and York; including two in private collections. Several were cast ashore in the Frith of Forth in 1851, one of them twenty-two inches and a half long. In the same season an example was taken at Redcar on the Norfolk coast, and another of equal size at Gamrie, Banffshire.

Ray's Bream is mentioned in Nilsson's *Prodromus* as occurring on the coast of Norway; and Professor Reinhardt, in a paper read before the Royal Society of Natural History and Mathematics of Denmark, has defined the northern limits of this species on that coast.

From this enumeration of specimens and localities, it will be evident that Cuvier, in his history of this fish, was deceived in supposing it to be peculiar to the Mediterranean, and that only a straggler occasionally wandered into the ocean; and, on the contrary, that Bloch and Lacépède were perfectly justified in considering this fish to be a native of the Northern Seas, as well as of the Mediterranean.

The genus *Brama* is a member of the third tribe of the *Squamipennes* family of Cuvier, which is characterized by the dentition. The family appellation used by Cuvier expresses well one of the most remarkable characters common to its members, but for the sake of uniformity, the family is here named after the typical genus *Chætodon*,

in conformity with the practice now generally adopted by English naturalists.

The following description of a recent fish is from the MS. of Mr. Couch:—"The specimen was twenty-three inches in length, and eight inches and a half in depth before the dorsal fin; the body is much compressed; the head small, and sloping in front; the snout short; the angle of the mouth depressed; the under jaw the longest; teeth slender, numerous, sharp, incurved, the inner row of the lower jaw longest; the tongue fleshy; eye large, rather oval, situated not far from the mouth; iris dark, pupil light; nostril single; gill-cover with two plates, the membrane concealed, and containing seven rays. Measuring along the curve, the dorsal fin begins seven and a half inches from the snout, having three shorter rays like blunt spines, each longer than that before it, the fourth ray longest; the fin then becomes narrower, and continues slender to within an inch of the root of the tail; anal fin shaped like the dorsal, beginning farther back, but ending opposite to it; pectoral fin six inches long, rather narrow, pointing obliquely upwards; ventrals triangular, with a long pointed scale in the axilla; tail deeply forked; lateral line near the back, obscure; head, body, and fins, except the pectorals and ventrals, covered with firmly-fixed scales, but a band across the forehead is scaleless, the colour of which, and also of the back, is a very dark blue; face cupreous brown; the sides and belly somewhat silvery; the anal and dorsal fins, and a stripe along the base of the latter, sparkle like silver; a green tint is visible before the dorsal fin; coppery and lake tints show along the upper part of the sides, and some dusky irregular stripes on the lower parts. The scales on the fins of this fish are arranged on the membranes in lines, so as to admit a slight degree of motion; the points of the rays

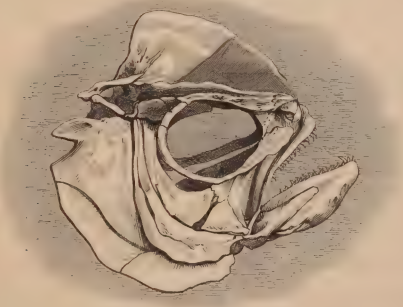
are also free. My fish was caught with a line near Polperro, October 26th, 1828, and was immediately brought to me; no elongated teeth were to be seen in this specimen."—*Couch*.

The number of fin-rays is as follows:—

D. 34: P. 19: V. 1+5: A. 2+28: C. 17.

The flesh of this fish is said to be of exquisite flavour: specimens have been taken that measured two feet six inches in length; but of twelve or fourteen examples that I have seen, the largest did not exceed sixteen inches.

SKULL OF RAY'S SEA BREAM.



THE ATHERINE, OR SANDSMELT.

Atherina presbyter, Cuv. et Valenc. Poiss. t. x. p. 439.
,, *hepsetus*, *Atherine*, Penn. Brit. Zool. vol. iii. p. 434, pl. 76.
,, ,, ,, Donov. Brit. Fish. pl. 87.
,, ,, ,, Flem. Brit. An. p. 217, sp. 160.
,, ,, ,, Jenyns, Brit. Vert. p. 377.

Atherinædæ. *Family Characters.*—Scaly fishes, with two dorsals and abdominal ventrals. A moderately-compressed, fusiform body, and generally a silvery stripe along the sides. Branchiostegals six. Premaxillaries very protractile; teeth very slender and thinly set; palatine teeth, in some species present, in others wanting. Stomach siphonal, membranous, only a little wider than the rest of the gut; pancreatic cæca none; peritoneum lined with black pigment; ova large; air-bladder often prolonged into a canal of the caudal vertebræ. Vertebræ more than twice as numerous as those of the Grey Mullets.

Atherina. *Generic Characters*, the same with the Family ones.

After carefully examining the Atherine of our southern coast, I found that it did not possess the characters of the Mediterranean species, named *hepsetus* by Linnæus, to which our British ichthyologists had previously referred it; and as it agreed with the *A. presbyter* of Cuvier, I adopted that name accordingly. Cuvier had indeed remarked that two species were confounded under the appellation of *hepsetus*.

"The Atherine is as plentiful on some parts of the

southern coast of England as the Smelt is on the eastern coast, and each appears to have its limits, so as not to intrude upon the other; at least, as far as our observation has gone, where one is, the other is not. We have traced the Smelt along the coast of Lincolnshire, and southward into Kent, where the Atherine appears to be unknown; but in Hampshire the Atherine is extremely plentiful, especially about Southampton, where, for want of knowing the true Smelt, it is sold under that denomination. On the south coast of Devon Atherines are caught in great abundance in the creeks and estuaries, but never above the flow of the tide; and they appear to continue near shore from autumn to spring, being caught for the table more or less during the whole of that time; but they are greatly superior in the spring, when the males are as full of milt as the females are of roe. The Atherine is a well-flavoured fish; though, in our opinion, not so good as the Smelt: it is more dry; but when in season, and fried without being embowelled, the liver and roe make it a delicious fish."—*Col. Montagu.*

The Atherine is a handsome small fish, from five to six inches in length; and though common in most of the sandy bays along the extended line of our southern coast, is but rarely brought to the London market.

Mr. Couch says it is found in Cornwall at all seasons, and sometimes in such numbers that three small boat-loads have been enclosed in a sean at once. From Cornwall its range extends eastward to near Beachy-head, and probably as far as Rye Bay or Dungeness; but it keeps close in shore in the smooth water, and seldom ventures into the rapid Channel tide, in its rush through the Straits of Dover.

The Atherine is a common fish at Brighton, where it is called Sandsmelt. Large quantities of it are eaten by

the inhabitants and visitors during the winter months. It possesses very little of the cucumber smell and flavour of the true Smelt; but as it is very pretty, from the fine broad silver stripe along the side, it looks attractive when arranged in the fishmongers' shops, and obtains a ready sale.

The net used for taking Atherines is made of fine thread-like twine, and the mesh is of course very small: the net is thirty yards long, and about eighteen feet deep. It is drawn along near the edge of the water, by two parties; one party in a boat, having the head and ground-line of the seaward end of the net, row gently on; the other party on the shore, at or near the edge of the water, advance in a line with the boat, holding and drawing on their end of the net, and thus sweep the circle of the bays and sandy shores. For those caught for the supply of Brighton market, I have seen the fishermen going westward, probably to the sandy shores of Shoreham or Worthing. I have also seen this mode of taking Atherine adopted in the bay close to the sea-houses near Eastbourne. Another method is practised in Portsmouth harbour. The fishermen use a concave circular net suspended from an iron ring of four feet diameter, kept horizontal by a three-slip bridle. The net is lowered steadily in eight feet water, among the timber floating on the side of the harbour nearest the dockyard. Pounded crabs sprinkled over the net as bait is the attraction; and the net is occasionally raised to the surface. In this way five or six dozen are obtained during the flood-tide. The Atherine also bites very readily at a hook baited with a rag-worm (*Nereis*).

I have not been able to learn that this fish is taken anywhere on the eastern coast of England; but it occurs, occasionally, on the east coast of the southern part of

Scotland. Dr. Neill states, in vol. i. of the Wernerian Transactions, that he has frequently found the Atherine washed ashore about Figget Whins, in the Frith of Forth, after easterly winds. Dr. Parnell says, "Of late years they have been undoubtedly scarce. Two instances only have occurred to me in which the Atherine was found in the Frith of Forth; the first was taken in Kincardine in company with Sprats, and other small fish; the second was drawn ashore in a net about two miles west of Newhaven. The fishermen say that it is more frequently met with in Guillon Bay." The Atherine is a delicate, and perhaps a tender fish, unable to bear a low temperature; Mr. Couch says, that during severe frosts large quantities are sometimes killed and left by the tide.

Mr. Thompson says of the Atherine, "This is taken plentifully on the coast of Down, especially in Strangford Lough. Of about forty specimens from this locality, which I examined in January 1835, the average length was six inches and one quarter, a few were seven inches, and one was seven inches and a half long. Mr. Ball informs me that the Atherine is not unfrequently taken along with Sprats at Youghal, and that on the 14th of September 1834, he saw a shoal of them at Portmarnock, county Dublin, where a stream had formed a pool in the sand below high-water mark. It is brought to Belfast market from December to April, both months inclusive." —*Nat. Hist. of Ireland,* vol. iii. p. 107.

The length of the head, from the point of the mandible to the edge of the operculum, compared to the length of the body and tail, is as one to four; the depth of the body is not quite equal to the length of the head; a silver-coloured lateral band, half as broad as the space above it, and one-third as broad as the space below it, passes from the upper edge of the operculum and the

base of the pectoral fin, to the centre of the base of the caudal fin; four rows of scales exist above the silver band, and six rows below it; the band itself occupying two rows.

The form of the head is rather short: the nose blunt; the upper jaw is capable of considerable protrusion, and the lower jaw is the longest when the mouth is open; one row of minute teeth arms the edge of each jaw: the eye is large; the top of the head is flat, with a ridge descending on each side to the nose.

The first dorsal fin commences about the length of the head from the nape; the second dorsal begins at the same distance behind the origin of the first, and ends at the same distance from the base of the caudal fin-rays; the ventrals originate opposite to the tips of the pectoral fin-rays, and the ventral and anal fins begin a little in advance of each dorsal fin respectively: the tail is deeply forked, and the longest rays nearly equal the length of the head; the vent is a small circular orifice under the tips of the first dorsal fin-rays when folded down.

Colour of the cheeks, irides, gill-covers, base of pectoral fins, and broad side band, shining silvery white; the other parts of the body have a pale transparent flesh colour; the upper parts of the back and head are freckled with small black spots, and the membranes of the fins are yellowish-white.

Considerable numbers of the Atherine are caught by anglers from projecting points at various localities along the southern coast. Poole Quay is a favourite spot. The fish bite voraciously at any bait that is offered to them, and even when they are heaviest with roe, which is not the case with fishes generally.

The spawning season is May or June.

1st D. 8: 2nd D. 1+12: P. 15: V. 1+5: A. 1+14: C. 17: Vert. 50.

THE GREY MULLET.

RAMADO, *Nice.*

Mugil capito, Cuv. et Valenc. Poiss. t. xi. p. 36.
,, *cephalus*, Willughby, p. 174, tab. R. 3.
,, ,, *Grey Mullet*, Penn. Brit. Zool. vol. iii. p. 346, pl. 77.
,, ,, ,, ,, Donov. Brit. Fish. pl. 15.

Mugilidæ. *Family Characters.*—Abdominal acanthopterous fishes, with a subcylindrical body, a broad back, two widely-separated dorsals, and large scales which extend over the head. Only four stiff, acute spines in the first dorsal. Teeth, when present, extremely fine; maxillaries small, nearly concealed by the thick premaxillary lip that presses against the preorbitar when the mouth is shut. Mandible shelving, with a small symphysial tubercle. Pharyngeals greatly developed, and permitting the entrance of only soft and thin matters into the narrow angular aperture of the œsophagus. Branchiostegals four, five, or six.

Mugil. *Generic Characters.*—Mouth small, opening transversely, and having a mesial crest on the under lip which fits a corresponding notch in the upper lip. Teeth excessively slender, so as to be scarcely visible. Preorbitar covering the side of the snout, finely pectinated, and receiving beneath its edge the slender maxillary. Gill-covers large and convex, covering a complicated pharyngeal apparatus. Stomach gizzard-like; intestine long and folded; pancreatic cæca few. Branchiostegals six.

Baron Cuvier, in the last edition of his *Règne Animal*, states, in a note at the foot of page 231, vol. ii., that Linnæus and several of his successors have confounded all the European Grey Mullets under one common name,—that of *Mugil cephalus;* and M. Valenciennes, in the *Histoire des Poissons*, has described seven of these Mullets, and pointed out their distinctive characters. The Prince of Musignano, who has described and figured in his *Fauna Italica* five species of Grey Mullets, gives an excellent figure of *M. capito*, which he considers to be the most common of the European species.

Mugil cephalus is distinguished by having its eyes partly covered with a semi-transparent membrane adhering to the anterior and posterior edges of the orbit, and also by a large elongated triangular scale pointing backwards, placed just over the base of the pectoral fin on each side. A dried specimen of this fish from the Mediterranean, now before me, exhibits both these peculiarities, which *M. capito* does not possess. The vignette below represents the appearance of the pectoral fin, and the superimposed triangular scale of *M. cephalus*, both for the purpose of supplying the means of comparison with our common Grey Mullet, in which the pectoral fin-scale is short and blunt, and to enable observers to identify the true *cephalus*, should it occur on our coast; which is not improbable, when it is recollected how many Mediterranean species have been recorded as occurring along the line of our southern shore.

The Grey Mullet is found plentifully in Cornwall and Devonshire, and along the whole line of our south coast. It occurs constantly on the Kentish and Essex shores; is taken at Yarmouth: Mr. Neill has met with it at the mouth of the Esk; it has been taken on the coast of Down, but it is much less common in the Irish seas than *M. chelo;* it exists moreover in the Baltic and the west coast of Norway according to Professors Reinhardt and Nilsson; and it occurs throughout the western shores of southern Europe and in the Mediterranean.

Mr. Couch, in his MS., has described the habits of this fish so much better than any account I could offer of my own, that I shall be excused for quoting his remarks at some length.

"This fish never goes to a great distance from land, but delights in shallow water when the weather is warm and fine; at which time it is seen prowling near the beach in search of food, and imprinting a dimple on the placid surface as it snatches beneath any oily substance that may chance to be swimming. It ventures to some distance up rivers, but always returns with the tide. Carew, the Cornish historian, had a pond of salt water, in which these fish were kept; and he says, that having been accustomed to feed them at a certain place every evening, they became so tame, that a knocking like that of chopping, would certainly cause them to assemble. The intelligence this argues may also be inferred from the skill and vigilance this fish displays in avoiding danger, more especially in effecting its escape in circumstances of great peril. When enclosed within a ground-sean or sweep-net, as soon as the danger is seen, and before the limits of its range are straitened, and when even the end of the net might be passed, it is its common habit to prefer the shorter course, and throw itself over the head-

line, and so escape; and when one of the company passes, all immediately follow. This disposition is so innate in the Grey Mullet, that young ones of minute size may be seen tumbling themselves head over tail in their active exertions to pass the head-line. I have even known a Mullet less than an inch in length to throw itself repeatedly over the side of a cup in which the water was an inch below the brim."

"Mullets frequently enter by the floodgate into a salt-water mill-pool at Looe, which contains about twenty acres; and the larger ones, having looked about for a turn or two, often return by the way they had come. When, however, the return of the tide has closed the gates, and prevented this, though the space within is sufficiently large for pleasure and safety, the idea of constraint and danger sets them on effecting their deliverance. The wall is examined in every part; and when the water is near the summit, efforts are made to throw themselves over, by which they are not uncommonly left on the bank to their own destruction."

"When, after being surrounded by a net, two or three have made their escape, and the margin of the net has been secured and elevated above the surface, to render certain the capture of the only remaining one, I have seen the anxious prisoner pass from end to end, examine every mesh and all the folds that lay on the ground, and at last, concluding that to pass through a mesh, or rend it, afforded the only though desperate chance of escape, it has retired to the greatest possible distance, which had not been done before, and rushed at once to that part which was most tightly stretched. It was held, however, by the middle; and conscious that all further effort must be unavailing, it yielded without a further struggle to its fate."

"The Grey Mullet selects food that is soft and fat, or such as has begun to suffer decomposition; in search of which it is often seen thrusting its mouth into the soft mud, and the lips appear to be furnished with exquisite sensibility of taste. It is, indeed, the only fish of which I am able to express my belief that it usually selects for food nothing that has life; although it sometimes swallows the common sand-worm. Its good success in escaping the hook commonly proceeds from its care not to swallow a particle of any large or hard substance; to avoid which, it repeatedly receives the bait into its mouth, and rejects it; so that when hooked it is in the lips, from which the weight and struggles of the fish often deliver it. It is most readily taken with bait formed of the fat entrails of a fish, or cabbage boiled in broth."

"The Grey Mullets shed their spawn about Midsummer; and the young in August, then an inch long, are seen entering the fresh water, keeping at some distance above the tide, but retiring as it recedes. The change and rechange from salt water to fresh seems necessary to their health, as I judge from having kept them in glass vessels."—*Couch.*

The Grey Mullet is frequently an object of sport to the angler. It rises freely at the flies used for Trout, and even at the larger and more gaudy flies used for Salmon. It is reported to be strong in the water, and requires care in management, as it plunges violently. The Mullet is angled for when the tide is coming in; as, on the ebb, it returns to salt water.

The county of Sussex is proverbially celebrated for six good things; viz. a Chichester lobster, a Selsey cockle, an Arundel mullet, a Pulborough eel, an Amberly trout, and a Rye herring. The Arundel Mullet, however, is the *Mugil chelo*, as I ascertained by two examples sent to

me from that place by Miss Constable. In reference to the Mullet, I may notice, that during the summer of 1834, probably owing to the warmth of the season, the Grey Mullets migrated much farther up the river Arun than usual, and were caught beyond the flow of even the spring tides, as high up as Amberg Castle, which is by the river nearly ten miles above the town of Arundel, and nearly twenty miles from the sea.

The partiality exhibited by the Grey Mullet for fresh water has led to actual experiment of the effect of confining them to it entirely. Mr. Arnould put a number of the fry of the Grey Mullet about the size of a finger into his pond at Guernsey, which is of about three acres' area, and has been before referred to under the article Basse. After a few years, Mullet of four pounds' weight were caught, which proved to be fatter, deeper, and heavier, for their length, than others obtained from the sea. Of all the various salt-water fishes introduced, the Grey Mullet appeared to be the most improved. A slight change in external colour is said to have been visible in these fresh-water Mullets.

The length of the head in this fish, compared with the length of the body and tail, is as one to four: the depth of the body is equal to the distance between the anterior edge of the orbit, and the end of the operculum, and the body does not decrease in size till the commencement of the anal fin: the fleshy portion of the tail is equal to half the depth of the body.

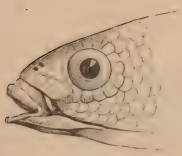
The form of the mouth is different from that of most other fishes. The lower jaw is divided in the middle by an ascending angular point, which, when the mouth is closed, passes within the upper jaw: filling a notch between the premaxillaries: the upper jaw, also, if viewed from below, is angular; each jaw is furnished with a

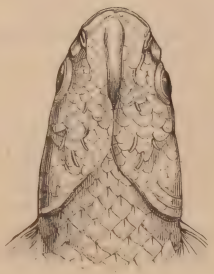
single row of minute teeth; the nostrils are situated in a depression, the anterior aperture being round, the posterior one vertically oblong.

D. 1+8: P. 17: V. 1+5: A. 3+9: C. 13.

The first dorsal fin commences behind the nape at a distance equal to the length of the head, and nearly midway between the origins of the ventral and anal fins; the second dorsal fin begins a little behind the commencement of the anal fin, and ends on a line with it. The lengths of the longest of the rays of all the fins are nearly equal, and measure three-fourths of the length of the head; except the caudal fin, which has longer rays, and is considerably forked. There are many mucous canals on the head, gill-plates, and shoulders of this fish.

The colour of the top of the head and back is dusky grey tinged with blue; the sides and belly are silvery white, marked with longitudinal parallel dusky lines; the membranes of the fins are dull white: the cheeks and operculum silvery white; the irides reddish-brown, and the pupil black, surrounded by a silvery line. There is a dark spot on the bases of three upper pectoral rays.





THE THICK-LIPPED GREY MULLET.

TAINHA DA MODO, *Madeira.*—SCIORINA, *Florence.*

Mugil chelo, Cuvier, Règne An. t. ii. p. 232.
,, ,, Cuvier et Valenc. Poiss. t. xi. p. 50.
,, ,, Il Princ. di Musignano, Faun. Ital. pt. vi.
,, ,, Thomps. Nat. Hist. of Irel. iii. p. 100.

Mr. Couch appears to be the first naturalist who noticed the appearance of *Mugil chelo* on the British coast, and came to the knowledge of the fact of its being a distinct species, which, though well known to modern Continental Ichthyologists, had not previously been ascertained by observers here.

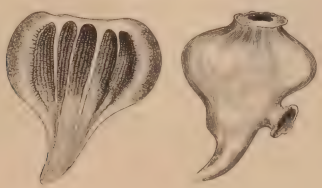
Mr. Couch's communication is as follows:—

"This Grey Mullet is gregarious, frequenting harbours and the mouths of rivers in the winter months, in large numbers, all of which are just of one size. I have heard of so many as two tons being taken at one time: but the fish which I shall here describe was taken with about four hundred others as they were left in a pool of our river, forsaken by the tide. This species has, like the other, the habit of escaping from a net by leaping over the head-lines. The length of the specimen was ten

inches: the head wide, and depressed; eyes one inch apart, and three-eighths of an inch from the angle of the mouth, not connected with any membrane; nostrils close together, and, while the fish is alive, movable on each contraction of the mouth: a prominent superior maxillary (preorbitar) bone minutely notched at its lower or posterior edge; upper lip protuberant and fleshy, with a thin margin minutely notched or ciliated; the lip appears behind as projecting from under the maxillary (preorbitar). Carina of the under jaw prominent and square; edge of the lower lip fine and simple. Body solid, round over the back: pectoral fins high on the side, pointed, rounded below, the first rays short. The first dorsal fin commences five inches and three-eighths from the snout, and the first three rays approximate at their bases, the first ray being the longest; the first two rays of the anal fin are short: the caudal fin broad, concave; scales larger than those of the preceding species. Colour of the head and back greenish; all besides silvery, with six or seven parallel lines along the sides, of the same colour as the back."

D. 4. 9: P. 14: V. 1+5: A. 3+8: C. 16.

The drawings of an external and internal view of the stomach of the *Mugil chelo* were made for me in June 1847, by F. W. L. Ross, Esq.



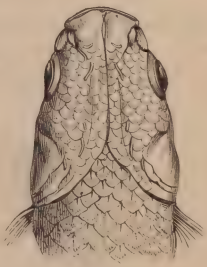
The figure of this fish is taken from the *Fauna Italica* of the Prince of Musignano, who distinguishes this species by the following specific characters :—

" Head of moderate size, subtruncated in front ; upper lip thickened, under lip very slightly bordered ; the end of the maxillary bone projecting below the suborbital bone ; the space between the edges of the interopercula very narrow ; the rays of the spiny dorsal fin longer than the half of the depth of the body."

The characters of *M. chelo*, as given by Cuvier in the *Règne Animal*, are, that it is distinguished particularly by its very large and fleshy lips, the edges of which are ciliated, and through their thickness the teeth penetrate, like so many hairs ; the maxillary bone is curved, and shows itself behind the commissure.

The Thick-lipped Grey Mullets weigh ordinarily under five pounds, but Mr. Thompson states that specimens weighing from ten to fifteen pounds are occasionally captured in Belfast Bay.

In order to assist observers in distinguishing between the two species of Grey Mullets most common on our



coasts, I have introduced these representations of the head of this species as seen from the side and from below, on the plan followed by the Prince of Musignano in his *Fauna Italica;* in which the larger size of the portion of the maxillary bone that descends from under the preorbitar, and the very narrow space between the inferior edges of the interopercula at the chin, contrast strongly with the same parts in *M. capito*, as represented in the vignette at p. 181.

There is now reason to believe that this Thick-lipped Grey Mullet is equally common with the last, on different parts of our coast. Dr. Parnell says, he has ascertained it to be excessively common in the months of September and October on the Devonshire coast, particularly off Exmouth, Teignmouth, and Brixham. Mr. Barron, Conservator of the Haslar Museum, observes that it is the most plentiful of the two species on the fishmongers' stalls at Portsmouth; and that it enters the harbour with the tide, keeping close along shore. Dr. George Johnston says it is of frequent occurrence in Berwick Bay in autumn; and Dr. Parnell adds that large shoals of this Grey Mullet appear occasionally on the east coast of Scotland. Sir William Jardine has sent me a specimen of twenty inches in length from the Solway Frith; and Mr. Thompson, of Belfast, in his Natural History of Ireland (edition of 1856), states that it frequents the eastern coasts of that island from north to south.*

* Mullets of different species are more or less plentiful at the Cape de Verd Islands, in the Caspian Sea, and seas of Japan, New South Wales, Sandwich Islands, in the Bay of Mexico, and in other localities.

THE SHORT GREY MULLET.

Mugil curtus, Yarrell.
,, ,, Cuvier et Valenc. Poiss. t. xi. p. 70.
,, ,, Jenyns, Brit. Vert. p. 376.

At the date of the publication of the first edition of the History of British Fishes, but one species of Grey Mullet had been described and figured as belonging to the British coast, the Small Grey Mullet of the present article being then unknown. Its principal distinction, as a species, is in the extreme shortness of the body, which has induced me to adopt for it the specific term *curtus*.

D. 4. 1 + 8 : P. 11 : V. 1 + 5 : A. 3 + 8 : C. 14.

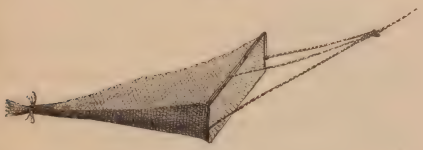
The length of the head as compared with that of the body and tail is as one to three, the proportion in the common Grey Mullet being as one to four; the body is also deeper in proportion than in *M. capito*, being equal to the length of the head; the head is wider, the form of it more triangular, and also more pointed anteriorly; the eye larger in proportion; the fin-rays longer, particularly those of the tail; the ventral fins placed nearer the pectorals, and a difference exists in the number of some of the fin-rays: the colours of the two species are

nearly alike; in other respects, except those named, they do not differ materially.

After the publication of my first notice of this species, the eleventh volume of the *Histoire Naturelle des Poissons* appeared containing a reference to this fish as quoted here, together with a notice of a larger example of the same species captured in the Somme by M. Baillon. That gentleman also thought it new and rare. His specimen was four inches long.

Of this Grey Mullet I have only obtained the single specimen that served for the representation given, which is exactly the natural size of the fish. I caught it with the young of the common Grey Mullet, and various other fry, when fishing with a small but very useful net between Brownsey Island and South Haven, at the mouth of Poole Harbour.

A KEERDRAG.



The net I used is called a *keerdrag*, and as it is an effective machine, where the ground is smooth, for the collectors of small fishes and various other marine animals, I have made a representation of it the subject of the vignette annexed, and will shortly describe the apparatus and the manner of working it.

The bottom and sides of the oblong mouth of the net

are formed of an iron rod about seven feet long, of which about fifteen inches at each end are bent once at a right angle; to these ends a straight beam of wood, three inches in diameter, is fixed, which should be chamfered on the edges for the convenience of handling. The wood by its buoyancy tends to preserve the vertical position of the framework in the water.

To the mouth of the net thus formed by the union of the iron and wood a piece of netting is to be applied all round, which should diminish gradually, both in the size of the net and its mesh, till, at the distance of seven or eight feet from the framework, it should terminate in a round open mouth, about the size of the top of a stocking. The mesh of the net for the last three feet should be very small, as it is at this part the most strenuous efforts to escape will be made; particularly by the *Syngnathi*.

The net is to be drawn along the ground by a rope passing over the stern of the boat, which should not be rowed fast. This tow-rope ends towards the net by a three-tie bridle, one of which is attached to the centre of the wooden beam: of the other two, one goes to each side, and thus the mouth of the net is not only kept square to the front, but its vertical position is also preserved.

The open tail of the net being closed and securely tied, and the apparatus put overboard from a row-boat, keeping hold of the tow-rope, and taking care that the mouth of the net preserves its position, it should be towed leisurely about, the iron bottom traversing the ground; the quantity of contents obtained soon lead to a knowledge of the best localities. Should the mouth of the net get foul of any opposing substance on the ground, it is only necessary to push the boat back in the line of its previous

course, and the net comes away clear, being thus pulled upon in the opposite direction.

On examining the net, the framework may be raised by the tow-rope high enough to lodge the wooden beam over the edge of the boat's stern,—but higher than that is unnecessary: the tail of the net is to be handed in, untied, and the contents shaken into a tub for examination: and while the net is again at work at the bottom, the collector may be engaged over the contents of his tub at the top.

The vignette below is taken from a drawing most obligingly made by Mr. Lear for this work.

THE RIVER ARUN AND ARUNDEL CASTLE.

THE TRUMPET-FISH. SEA-SNIPE.

WOODCOCK-FISH,—BELLOWS-FISH, *Cornwall.*

Centriscus scolopax, Linnæus. Bloch, pt. iv. pl. 123, fig. 1.
,, ,, Cuvier, Règne An. t. ii. p. 268.
,, ,, *Snipe-nosed Trumpet-fish*, Penn. Brit. Zool. iii. 190.
,, ,, *Snipe-fish*, Donov. Brit. Fish. pl. 63.
,, ,, *Trumpet-fish*, Flem. Brit. An. p. 220, sp. 170.

Aulostomidæ. *Family Characters.*—The nasal, vomer, preopercula, interopercula, pterygoids, and tympanics prolonged into a long tube, with the small mouth at the extremity formed, as usual, of the premaxillaries, maxillaries, palatines, and mandible. The intestines have no great dilatations, and few or no pyloric cæca ; and the ribs are short or wholly absent. Form of body various, long or short, high and compressed, scaly, and often protected by radiated plates. Soft dorsal, opposed to the anal. Few branchiostegals. An air-bladder.

Centriscus. *Generic Characters.*—Body oval, compressed ; belly acute : small contiguous ventrals ; spinous dorsal far back, commencing with a tall, strong, serrated spine, having small spinous rays in its axilla, and various denticulated plates flanking its base. Toothless mouth, very small, opening obliquely at the end of the long facial tube. Skin clothed with small scales, and with a series of striated plates on the edge of the belly and on the shoulder. No pancreatic cæca : intestine folded three or four times : air-bladder considerable.

A Trumpet-Fish is recorded in the eighth volume of the Transactions of the Linnean Society to have been thrown ashore at St. Austle's Bay, in Cornwall, early in

the year 1804: it was five inches long. Sir Thomas Brown says that a *Scolopax*, or Sea-Woodcock, of Rondelet, was given to him by a seaman of these seas. Mr. Donovan refers to two instances of the taking of this species within his knowledge, and he appears to have had two specimens in his collection. Mr. R. Q. Couch also mentions in the Zoologist (1612) the capture of one in Mount's Bay, and another off Cape Cornwall: so that we can reckon six instances of its being taken on our coasts.

The Trumpet-Fish was first described and figured by Rondelet, and it is not uncommon in some parts of the Mediterranean. Risso says it prefers a muddy bottom in moderately deep water, and that it spawns in spring. The young are seen near the shore in autumn, shining with a brilliant silvery lustre, not having then acquired the golden red of the adult fish; they are not very numerous, but they do not wander far from the locality in which they are bred. Their food is not mentioned by authors, though it probably consists of minute crustaceous animals: and in reference to their tubular faces, it is probable that by dilating their throat they can draw their food in, as water is sucked up the pipe of a syringe. The mouth also placed at the end of the lengthened conical face is well adapted for picking up minute animals from among the various sorts of sea-weed. The flesh of the Trumpet-Fish is considered good.

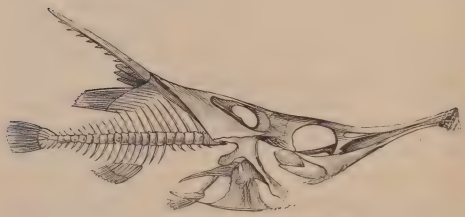
The facial tube extends an inch and a half before the eyes; the mouth at the extremity is small, without teeth; the eyes are large, the irides silvery, streaked with red, and the pupils black. The back in the specimen now before me, and from which the figure was taken, is elevated, forming a slight ridge, and ending in a short spine just in advance of the long and strong denticulated spine of the

first dorsal fin. That fin, in this specimen, has but three spinous rays, as shown in the figure; but authors generally state them to be four. The first spine is three times as long, and also very much stronger, than the others, pointed, movable, and toothed like a saw posteriorly, constituting a formidable weapon of defence; the other spines are slender and short, but their points project beyond the connecting membrane; the rays of the second dorsal fin are soft. The shape of the body is oval, and compressed; the pectoral fin is small; the ventrals are also small, with a depression behind them in which they can be lodged. The anal fin is elongated, its rays short. The number of fin-rays is—

D. 3 or 4—12: P. 17: V. 4: A. 18: C. 16.

The colour of the back is red, the sides rather lighter; the sides of the head and belly silvery, tinged with gold-colour; the scales on the body are hard, rough, minutely ciliated at the free edge, and granulated on the disk. All the fins are greyish-white.

The vignette below represents the skeleton of this singular fish.



THE MACKEREL.

MACRELL, *Wales.*—RIONACH, *Celtic Scotland.*

Scomber scomber, Linn. Bloch, pt. ii. pl. 54.
,, *scombrus*, Cuv. et Valenc. Poiss. t. viii. p. 6.
,, ,, *Common Mackerel*, Penn. Brit. Zool. iii. p. 357, pl. 62.
,, ,, *Mackerel*, Donov. Brit. Fish. pl. 122.

Scombridæ. *Family Characters.*—Scales generally small, tender, and smooth, seldom encroaching on the vertical fins; bones usually spongy and fibrous. Tail peculiarly slender at the origin of the crescentic caudal fin, but vigorous. Pancreatic cæca numerous, united in bunches. Opercular bones unarmed. Front anal spines often detached, as are also those of the first dorsal in some genera; sometimes the posterior branching rays of the second dorsal and anal are detached, forming finlets. Lateral line often keeled on the tail, sometimes armed with acute shield-like scales; and there is, in some members of the family, a short oblique crest on the base of each lobe of the caudal fin.

Scomber. *Generic Characters.*—Body fusiform, with a space between the two dorsals; caudal fin large, set on a very slender tail, and with a pair of short, oblique, cutaneous crests on each side, but no acute keel on the lateral line. Detached finlets behind dorsal and anal. Air-bladder, in some species, absent. Branchiostegals seven.

The Mackerel is so well known for the beauty and brilliancy of its colours, the elegance of its form, and its intrinsic value to man as an article of food, both in reference to quantity and quality, that farther observation on these points will be considered unnecessary.

The Mackerel was supposed by Anderson, Duhamel, and others to be a fish of passage, performing, like some birds, certain periodical migrations, and making long voyages from north to south at one season of the year, and the reverse at another. It does not appear to have been sufficiently considered that, inhabiting a medium which varied but little locally, either in its temperature or productions, fishes are removed beyond the influence of the two principal causes which make a temporary change of situation necessary. Independently of the difficulty of tracing the course pursued through so vast an expanse of water, the order of the appearance of the fish at different places on the shores of the temperate and southern parts of Europe is the reverse of that which, according to their theory, ought to have happened. As it is known that this fish is now taken on some parts of our own coast in every month of the year it is probable that the Mackerel inhabits almost the whole of the European seas; and the law of nature, which obliges it and many other fish to visit the shallower water of the shores at a particular season, appears to be one of those wise and bountiful provisions of the Creator, by which the species is perpetuated with greater certainty, and a large quantity of wholesome food is periodically brought within the reach of man. Were the Mackerels dispersed over the immense surface of the deep, no effective fishery could be carried on; but, approaching the shore, as they do, from all directions, and roving along the coast in immense sculls, millions are caught, which

yet form but a very small portion compared with the myriads that escape. It may be observed further, that there is scarcely a month throughout the year in which the fishes of some one or more species are not thus brought within the reach of man by the operation of the imperative law of nature referred to.

On the coast of Ireland, the Mackerel is taken from the county of Kerry in the west, along the southern shore, eastward, to Cork and Waterford; from thence northward to Antrim, and north-west to Londonderry and Donegal. Dr. M'Culloch says it visits some of the lochs of the Western Islands, but is not considered very abundant. On the Cornish coast, this fish in some seasons occurs as early as the month of March, and then appears to be pursuing a course from west to east. It is plentiful on the Devonshire coast, and swarms in West Bay about June. On the Hampshire and Sussex coasts, particularly the latter, it arrives as early as March; and sometimes, as will be shown, even in February: and the earlier in the year the fishermen go to look for it, the further from the shore do they find it. Duhamel says the Mackerel is caught earlier at Dunkirk than at Dieppe, or Havre: on our own coast, however, the fishing is later, to the eastward. The fishermen of Lowestoffe and Yarmouth gain their great harvest from the Mackerel in May and June. Mr. Neill says it occurs in the Forth at the end of summer; and Mr. Low, in his *Fauna Orcadensis*, states that it does not make its appearance there till the last week in July or the first week in August.

The Mackerel spawns in June; and, according to Bloch, five hundred and forty thousand ova have been counted in one female. I have observed, by the

Mackerel sent to the London market from Worthing and its vicinity, that these fish mature their roe earlier on that flat sandy shore than in the deep water off Brighton. The young Mackerel, which are called Shiners, are from four to six inches long by the end of August. They are half-grown by November; when they retire, says Mr. Couch, "to deep water, and are seen no more that winter: but the adult fishes never wholly quit the Cornish coast; and it is common to see some taken with lines in every month of the year." Their principal food is probably the fry of other fish; and at Hastings the Mackerel follow towards the shore a small species of *Clupea*, which is there called, in consequence, Mackerel mint. I have been unable hitherto to obtain any specimens of this small fish; but, from various descriptions, I think it is probably the young of the Sprat. It is described as being about one inch long in July.

Mackerel are voracious feeders, and their growth is rapid. The ordinary length varies from fourteen to sixteen inches, and their weight is about two pounds each: but they are said to attain the length of twenty inches, with a proportionate increase in weight. The largest fish are not, however, considered the best for the table. I have a note of one caught at Poulton, in November 1849, which measured eighteen inches in length, and weighed two pounds and a half; and one caught at Hastings, and sent to the London market in November 1856, weighed two ounces more.

As an article of food, they are in great request; and those taken in the months of May and June are generally considered to be superior in flavour to those taken either earlier in spring or in autumn. To be eaten in perfection, this fish should be very fresh: as it soon becomes

unfit for food, some facilities in the way of sale have been afforded to the dealers in a commodity so perishable. Mackerel were first allowed to be cried through the streets of London on a Sunday in 1698, and the practice prevails to the present time.

At our various fishing-towns on the coast, the Mackerel season is one of great bustle and activity. The frequent departures and arrivals of boats at this time form a lively contrast to the ordinary routine of other periods; the high price obtained for the early cargoes, and the large return gained generally from the enormous numbers of this fish sometimes captured in a single night, being inducements to great exertions. A few particulars, from various sources, may not be uninteresting.

In May 1807 the first Brighton boat-load of Mackerel sold at Billingsgate for forty guineas per hundred,—seven shillings each, reckoning six score to a hundred: the highest price ever known at that market. The next boat-load produced but thirteen guineas per hundred. Mackerel were so plentiful at Dover in 1808, that they were sold sixty for a shilling. At Brighton, in June of the same year, the scull of Mackerel was so great, and one of the boats had the meshes of her nets so completely filled by them, that it was impossible to drag them in; the fish and nets, therefore, in the end, sunk together; whereby the fishermen sustained a loss of nearly 60*l.*, exclusive of what the cargo, could it have been got into the boat, would have produced. The success of the fishery in 1821 was beyond all precedent. The value of the catch of sixteen boats from Lowestoffe, on the 30th of June, amounted to 5252*l.*; and it is supposed that there was no less an amount than 14,000*l.* altogether realised by the owners and men concerned in

the fishery of the Suffolk coast.* In March 1833, on a Sunday, four Hastings boats brought on shore ten thousand eight hundred Mackerel; and the next day two boats brought seven thousand fish. Early in the month of February 1834, one boat's crew from Hastings cleared 100*l.* by the fish caught in one night; and a large quantity of very fine Mackerel appeared in the London market in the second week of the same month. They were cried in the streets of London three for a shilling on the 14th and 22nd of March 1834, and had then been plentiful for a month. The boats engaged in the Mackerel fishery are usually attended by other fast-sailing vessels, which are sent away with the fish as they are taken. From some situations, these vessels sail direct for the London market; at others, they make for the nearest point from which they can obtain land-carriage for their fish. From Hastings, and other towns on the Sussex coast, the fish are brought to London by vans, which travel up during the night.

The most common mode of fishing for Mackerel, and the way in which the greatest numbers are taken, is by drift-nets. The drift-net is twenty feet deep, by one hundred and twenty feet long; well corked at the top, but without lead at the bottom. They are made of fine twine, which is tanned of a reddish-brown colour, to preserve it from the action of the sea-water, and render it more durable. The size of the mesh is about two and a half inches, or rather larger. Twelve, fifteen, and sometimes eighteen of these nets are attached lengthways along a thick rope, called the drift-rope, the end of each net being also secured to the succeeding one. When arranged

* In an interesting sketch of the Natural History of Yarmouth and its neighbourhood, by C. and J. Paget, it is stated that, in 1823, one hundred and forty-two lasts of Mackerel were taken there. A last is ten thousand.

for use, a large buoy attached to the end of the drift-rope is thrown overboard, the vessel is put before the wind, and, as she sails along, the rope with the nets attached is passed over the stern into the water till the whole are run out. The nets, as thus deposited, hang suspended perpendicularly in the water, twenty feet deep from the drift-rope, and extend from three quarters of a mile to a mile, or even a mile and a half, according to the number of nets belonging to the party. When the whole of the nets have been handed out, the drift-rope is shifted from the stern to the bow of the vessel, and she rides by it as if at anchor; her weight keeping the nets strained in a straight line, which, without this pull upon the drift-rope, would not be the case. The nets are shot in the evening, and sometimes hauled once during the night, at other times allowed to remain in the water all night. The fish roving in the dark through the water, get into the meshes of the net, which are large enough to admit them beyond the gill-covers and pectoral fins, but not to allow the thickest part of the body to pass through. In the morning early, preparations are made for hauling in the nets. A capstan on the deck is manned, about which two turns of the drift-rope are taken. One man stands forward to untie the upper edge of each net from the drift-rope, which is called casting off the lashings; others hand in the net with the fish caught, to which one side of the vessel is devoted; the other side is occupied by the drift-rope, which is wound in by the men at the capstan. The whole of the nets having been got in, and the fish secured, the vessel runs into harbour with her fish; or, depositing them on board some other boat in company, that carries for the party to the nearest market, remains at sea for the next night's operations.

Near to land, another mode of fishing is adopted, which is thus described by Mr. Couch :—"A long, deep net is employed, of which, unlike the former, the meshes are too small to admit any of the fish. Two boats are necessary; one of which is rowed round the scull,* while the net is thrown overboard by two men to enclose it: the other boat is employed in keeping steady the end of the net, and warping it, the sooner and more surely to prevent the escape of the fish. When this is effected, the seine stands like a circle enclosing the captives, and the men proceed to draw it together at the ends and bottom; at the same time throwing pebbles at that place where the circle closes, to deter the approach of the fish to the only place where escape is possible. When at last the enclosure is perfect, and the net is raised from the ground, the fish thus brought to the surface are taken on board in flaskets. Such is the mode of proceeding with the seine in deep water, or at a distance from shore; but in some places it is hauled on the beach in the manner of a ground-net, with less trouble and expense."

"A third mode of fishing is with the line, and is called railing (trailing). The Mackerel will bite at any bait that is used to take the smaller kinds of fish; but gives preference to what resembles a living and active prey, which is imitated by a lask,—that is, a long slice cut from the side of one of its own kind, near the tail. It is found, also, that a slip of red leather, or a piece of scarlet cloth, will commonly succeed; and a scarlet coat has therefore been called a Mackerel bait for a lady. The boat is placed under sail, and a smart breeze is considered favourable; hence termed a Mackerel breeze.

* ———— In sculls that oft
Bank the mid sea.—Milton.
This word is, in Cornwall, pronounced like *school*.

The line is short, but is weighed down by a heavy plummet; and in this manner, when these fish abound, two men will take from five hundred to a thousand in a day. It is singular that the greatest number of Mackerel are caught when the boat moves most rapidly, and that even then the hook is commonly gorged. It seems that the Mackerel takes its food by striking across the course of what it supposes to be its flying prey. A gloomy atmosphere materially aids this kind of fishing for Mackerel."

Mr. Couch adds, that "French fishing-boats from the eastern ports of that country proceed early in the spring as far west as Cape Clear, and the fish taken in their nets are salted in bulk on board the boats. They obtain two or three full cargoes in the course of the summer; which proves that more use is made of salted Mackerel in France than in this country." A small quantity so preserved in Cornwall is consumed by the poorer classes of that county.

The accompanying pen-and-ink sketch by Mr. Couch represents the apparatus as used when fishing for Mackerel. The ascending line is that which hangs from the boat; the line connecting the leaden plummet and the hook is called the snood or snoozing; the lask or bait is cut thick near the hook, and thinner backwards, that it may vibrate when drawn through the water.

This mode of fishing has been described in glowing terms by the author of Wild Sports of the West (of Ireland) thus:—

"It was evident that the bay was full of Mackerel. In every direction, and as far as the eye could range, gulls and puffins were collected; and to judge by their activity and clamour, there appeared ample employment for them among the fry beneath. We immediately bore away for the place where these birds were most numerously congregated, and the lines were scarcely overboard when we found ourselves in the centre of a scull of Mackerel."

"The hooker, however, had too much way; we lowered the foresail, double-reefed the mainsail, and then went steadily to work. Directed by the movements of the birds, we followed the Mackerel, tacking or wearing the boat occasionally, when we found that we had overrun the scull. For two hours we killed those beautiful fish, as fast as the baits could be renewed and the lines hauled in; and when we left off fishing, actually wearied with sport, we found that we had taken above five hundred, including a number of the coarser species, known on this coast by the name of Horse Mackerel."

"There is not on sea or river, always excepting angling for Salmon, any sport comparable to this delightful amusement; full of life and bustle, everything about it is animated and exhilarating; a brisk breeze, a fair sky, the boat in quick and constant motion, all is calculated to interest and excite. He who has experienced the glorious sensations of sailing on the western ocean, a bright autumnal sky above, a deep green lucid swell around, a steady breeze, and as much of it as the hooker can stand up to, will estimate the exquisite enjoyment our morning's Mackerel fishing afforded."

"A novel and successful bait recently used is about two inches of the stem of a tobacco pipe, put on the line down to the hook."—*Ball, Thompson's Nat. Hist. of Ireland.*

The number of fin-rays in the Mackerel is—

D. 10—13—V: P. 13: V. 6: A. 11—V.: C. 22.

The nose is pointed, and the under jaw is the longest; the subulate teeth are alike in both jaws, curve slightly inward, and stand in a single row; the anterior edge of the eye is at one-third of the distance from the point of the upper jaw to the edge of the operculum; the irides are partly concealed by a membrane before and behind, and the eye itself is said to be more or less opaque during the colder months: the preoperculum is triangular; the operculum large, rounded, and smooth: the pectoral and ventral fins are both in advance of the first ray of the first dorsal fin, the pectoral fin the most so; the vent is under the first ray of the second dorsal fin; the five finlets above and below behind the second dorsal and the anal fins are placed vertically over each other; the tail fin is crescent shaped; the lateral line ascends gradually from the tail rising over the pectoral fin. Above the lateral line the colour is a fine green, varied with rich blue, and marked with broad, dark, descending lines. Mr. Donovan says, "The males have these dark transverse bands nearly straight; while in females they are elegantly undulated." The sides and belly have a silvery lustre varied with brilliant gleams of gold. The elongated gill-cover and more attenuated form of body of the males of fish generally, compared with the shorter gill-cover and deeper body of the females, are good sexual distinctions.

THE SPANISH MACKEREL.

Scomber colias, Gmelin. Cuvier et Valenc. t. viii. p. 39, pl. 209.
,, ,, *Coly Mackrel*, Turton, Brit. Fauna, p. 100, sp. 76.
,, *maculatus*, *Spanish M.*, Couch, Mag. Nat. Hist. v. p. 22, f. 8.

Mr. Couch and Dr. Turton were the first British naturalists who noticed this second species of Mackerel on the British coast; and I quote here by permission the description of this fish by Mr. Couch, who states that a few examples are taken every year on the Cornish coast.

"The specimen described measured fourteen and a half inches in length: its body was round and plump, six and a half inches in compass near the pectoral fins, the thickness being carried far towards the tail. Mouth large, the jaws of equal length; teeth small; tongue movable and pointed: head large and long; eye large; distance from the snout to the pectoral fin three and a half inches. Rays of the gill-membrane six, concealed. Lateral line at first slightly descending, then straight. Scales existing on the superior plate of the gill-covers, as well as on the body. First dorsal fin standing in a depression having seven rays, the first one shorter than

the second or third, which are of equal lengths: spurious fins six above and six below, the anterior one not high: tail-fin divided, and its base on each side doubly carinated: vent prominent. Colour dark blue on the back; striped like a Mackerel, but more obscurely, and with fewer stripes: a row of large dark spots ranges along the back from the pectoral fin to the tail, and the sides and belly are thickly covered with smaller dusky spots: the tail, gill-covers, sides, and behind the eye, are bright yellow.

"From the Mackerel, which it resembles, this fish differs in the markings of the head, longer snout, larger eye and gape, longer head, and in having scales on the anterior gill-covers. The body is not nearly so much attenuated posteriorly; the ventral fins are sharp and slender, those of the Mackerel wider and more blunt: in the former the pectorals lie close to the body, in the latter they stand off; in the latter, also, there is a large angular plate, the point directed backward, close above each pectoral fin, which does not exist in the Spanish Mackerel. It seems to be the *Colias Rondeletii* of Ray (*Syn. Pisc.* p. 59). I have given it the name by which it is known to our fishermen."

"This fish is scarce, but some are taken every year. It does not often take a bait, although the fishermen inform me that this sometimes happens, and that its infrequency is owing to the difference of feeding rather than to want of rapacity. It is more frequently taken in drift-nets; but even then it is only one at a time, and at considerable intervals. It is in no estimation as food."—*Jonathan Couch, Esq.*

Mr. R. Q. Couch, writing in 1846, says, "The Spanish Mackerel is not so elegant either in shape or marking as the Common Mackerel. It is now a rare species, but the

fishermen tell me that eight or nine years ago many hundreds were caught every year."—*Zool.*, 1411. In 1850 a number were caught in a seine off Brighton.—*Ar. Hussey, Zool.* 2929.

The figure of this fish at the head of the article is from the first plate quoted.

Dr. Turton states that the species he has described under the name of the Coly Mackerel is found frequently in the rivers about Swansea, and seldom exceeds six or seven inches in length: he also adds, that it is varied with rich green and blue; the spurious fins are five above and five below. Although Dr. Turton has called his second species of Mackerel *S. colias*, it is possible that his fish may prove to be the *Scomber pneumatophorus*, which also occurs in the Mediterranean; and measures eight or ten inches in length. It was named *pneumatophorus* by M. Laroche, on account of its possessing a swim-bladder. *S. colias* is also provided with a swim-bladder: the common Mackerel, *S. Scombrus*, Linn., is, as before mentioned, without any.

AN ENGLISH SKIFF.

Square-built, hearty, and strong, with an odor of ocean about him.
LONGFELLOW.

DOTTED MACKEREL.

Scomber punctatus, Couch, Zool. 1849, p. xxix. App. fig.
,, ,, Id. Rep. to Penz. Nat. Hist. Soc. for 1848, pl. iii. f. 1.
,, ,, White, Cat. Brit. Mus. p. 30.

This fish was taken in a Mackerel Seine at Looe, in Cornwall, on the 6th of July, 1848, and fortunately fell into the hands of Jonathan Couch, Esq., the able and industrious cultivator of Cornish ichthylogy. As no second example has as yet been met with, and the chief peculiarities of the Dotted Mackerel are its colours and markings, its specific rank may remain a question, until the acquisition of other specimens furnish the means of investigating its internal structure. In the meanwhile Mr. Couch's description is quoted from the Zoologist. The figure is from a drawing by him.

"The length of the specimen was fifteen inches and a half, and the general proportions were those of the Common Mackerel. Conspicuous scales, marked by minute transverse lines, cover the sides and belly, where none are distinguishable in the common species. There was no corselet, but there was some appearance of it in

a line of denser scales above the pectoral fin which vanished below that fin. The dorsals were three inches apart.

D. 12—11, V: P. 20.

"The tail at the setting on of the caudal fin is depressed and square. Lateral line waved. The colour afforded a marked distinction from the Common Mackerel, being of an uniform dark neutral tint, or bluish-olive, green on the head and back without any coloured bands or variations, but with green reflections on the sides: round, well-defined spots, of the size of a small pea, cover the sides thickly from head to tail; on the summit of the back they are a little larger, and are transversely elongated; they end a little below the lateral line, the belly being pure white. Between the caudal crests the surface is a bronzed yellow. The specimen was a female, and had an air-bladder."—*Couch, l. c.*

"A fish; a strange fish; a very ancient and fish-like smell."
SHAKSPEARE.

THE TUNNY.

MACRELL YSPAEN, *Wales.*

Thynnus vulgaris, CUVIER et VALENC. Poiss. t. viii. p. 58, pl. 210.
Scomber thynnus, LINNÆUS. BLOCH, pt. ii. pl. 55.
,, ,, *Tunny*, PENN. Brit. Zool. vol. iii. p. 360, pl. 63.
,, ,, ,, DONOV. Brit. Fish. pl. 5.
,, ,, ,, FLEM. Brit. An. p. 218.
,, ,, *Common Tunny*, JENYNS, Brit. Vert. p. 362.

THYNNUS. *Generic Characters.*—Dorsals two, contiguous. A thoracic corselet of larger and stronger scales, which ends posteriorly in points; lateral line unarmed, but having a cartilaginous, keel-like crest at its caudal termination. No free spine in front of the dorsal or anal, but numerous finlets posteriorly; lobes of the vertical fins falcate. Branchiostegals seven.

THE TUNNY was known to Aristotle; and its goodness and beauty have made it a favourite theme of writers on the fishes of the Mediterranean, ancient as well as modern. The Tunny fishery, moreover, is of great antiquity and value.

The Tunny is said to acquire a very large size. Although the specimens usually taken seldom exceed four feet in length, and frequently not more than three, Pennant saw one killed at Inverary in 1769, that weighed four hundred and sixty pounds, and was seven feet ten

inches in length; and larger individuals are recorded to have been taken in the Mediterranean. There the habits of this fish have been studied with attention, its immense numbers affording great facilities. The roe is said to be of very rapid growth, and is deposited early in June. In July the young Tunnies do not weigh more than an ounce and a half; in August they weigh four ounces; and in October they weigh thirty ounces. In the months of May and June, when seeking a proper situation near the shore whereon to deposit their spawn, the adult fish rove along the coast in large sculls, and are known to be extremely timid, and easily induced to take a new course to avoid any suspected danger. Advantage has been taken of these peculiarities to carry on a most extensive fishery of them at various places, which is as valuable as it is destructive. Cuvier and M. Valenciennes have described the two most common methods of effecting their capture. When the look-out sentinel, posted for that purpose on some elevated spot, makes the signal that he sees the scull of Tunnies approaching, and the direction in which it will come, a great number of boats set off under the command of a chief, range themselves in a line forming part of a circle, and joining their nets, form an enclosure which alarms the fish, while the fishermen drawing closer and closer, and adding fresh nets, still continue driving the Tunnies towards the shore. When they have reached the shallow water, a large net is used, having a cone-shaped tunnel to receive the fish, which is drawn to the shore, bringing with it all the scull. The fishermen carry out the small Tunnies in their arms; the larger ones are first killed with poles. This fishery, practised on the coasts of Languedoc, sometimes yields many hundred weight at each sweep of the nets.

Another mode of taking Tunnies is by the *madrague*, or, as the Italians call it, *tonnaro*. This is a more complicated and expensive engine. It consists of a series of long and deep nets supported vertically by corks at their upper edges, and with lead and stones at the bottom. They are anchored so as to form an enclosure parallel to the coast, sometimes extending an Italian mile in length: this is divided into several chambers by transverse nets that leave narrow openings on the land side. The Tunnies, which in their progress, as before observed, proceed along the coast, pass between it and the tonnaro: when arrived at the end, they are stopped by one of the cross nets, which closes the passage against them, and obliges them to enter the tonnaro by the opening that is left for them. When once in, they are driven by various means from chamber to chamber until they enter the last, which is called the chamber of death. Here a strong net placed horizontally, that can be raised at pleasure, brings the Tunnies to the surface, and the work of destruction commences. Sailors who have come off in boats for the purpose give unequal battle on all sides, striking the Tunnies with poles and all sorts of similar weapons. This imposing spectacle, which attracts a great number of curious people to witness it, is one of the great amusements of rich Sicilians, and, at the same time, supplies one of the most considerable branches of the commerce of the island. When Louis the Thirteenth visited Marseilles, he was invited to a Tunny fishing at the principal *madrague* of Morgion; and found the diversion so much to his taste, that he often said it was the pleasantest day he had spent in his whole progress through the south.

The mode of curing the fish consists in taking out the whole of the inside, washing the flesh with brine, and

cutting it in slices, which are covered with pounded salt. These are packed in barrels, with alternate layers of salt. When sent to a distance, the cured fish is packed in smaller barrels with fresh salt.

The flesh of the Tunny is considered very delicious food; but it is so solid, that it seems something between fish and meat: it is as firm as Sturgeon, but finer flavoured. "They dress this fish in France," says an author, "in a great variety of ways, and every way excellent: it makes capital soup; or it is served as a ragout, or plain fried or broiled: pies are made of it, which are so celebrated as to be sent all over France; they will keep good for six weeks or two months. There is also a mode of preserving it to keep the whole year round with salt and oil, called *Thon mariné:* this is eaten cold, as we eat pickled Salmon." The flesh before it is cooked has the red appearance of beef, but when dressed it becomes more pale.

In the ocean, and on the western shores of the European Continent, the appearance of the Tunny is more rare,—almost accidental. Duhamel records having known it to be taken off Brest Harbour. Mr. Couch has noticed its appearance on the Cornish coast, and Mr. Donovan states that, in 1801, three Tunnies were taken near the entrance of the river Thames, and brought to Billingsgate Market for sale. One eight feet and a half long was caught off Chesil beach, in July 1850, and in the same year a scull of them entered Moray Firth, several of which were killed. In March 1851, one that weighed three hundred and sixteen pounds was taken off Dartmouth in a Mackerel net. Mr. Paget says that small specimens are not unfrequently caught during the Mackerel fishery off Yarmouth. They have been taken among the islands west and north of Scotland, where they are

called Mackrelsture or Mackerelstawr (Great Mackerel); a name derived from the Scandinavian word *stor*, which signifies 'great.'

Dr. Scouler has communicated to the Magazine of Natural History a notice (vol. vi. p. 559) of a specimen of a Tunny captured in the Gair-loch, nearly opposite Greenock, in July 1831. It had entered the loch in pursuit of Herrings, got entangled among the nets, was sent by the fishermen to Glasgow, and is now deposited in the Andersonian Museum. This specimen exceeded the average size, being nine feet in length. Another of equal length, and five feet ten inches in girth, was caught in 1850 off Craithie, and is preserved in Marischal College, Aberdeen. Mr. Thompson mentions only two instances of its having been taken on the Irish coast. One obtained in 1841, off the coast of Down, was eight feet three inches long, five feet four inches in girth, and weighed three hundred pounds.

Mr. Couch states that "the Tunny appears on the Cornish coast in summer and autumn; but is not often taken, because it does not swallow a bait, or at least the fishermen use no bait that is acceptable to it; and its size and strength seldom suffer it to become entangled in their nets. It feeds on Pilchards, Herrings, and perhaps most other small fishes; but the Skipper, *Esox saurus*, seems to be a favourite prey; for the Tunny not only compels it to seek another element for safety, but will also spring to a considerable height after it,—usually across its course, at the same time attempting to strike down the prey with its tail. Osbeck says it feeds eagerly on the cuttle."

The fin-rays are as follows:—

D. 14—1+13—VIII.: P. 31: V. 1+5: A. 2+12—VIII.: C. 19.

The general form of the Tunny is similar to that of the well-known Mackerel, except that it is larger, and more

rounded, and that the jaws are shorter; the lower jaw is very little longer than the upper one; the mouth is not deeply cleft; each jaw is furnished with a row of small teeth as sharp as pins, and slightly curved inwards; the tongue and the inside of the mouth are very dark-coloured, almost black; the eye is surrounded by a membrane within the orbit, which covers part of its disk; the cheeks are covered with long, narrow, pointed scales; the operculum is smooth: the first dorsal fin is lodged in an elongated depression, which conceals it when it is folded down: a small spine stands before the commencement of the second dorsal fin, and the fin is followed by eight or nine finlets, or ten, an apparent tenth being sometimes detached from the caudal: the anal fin, preceded by two short spines, commences nearly on a line with the origin of the last ray of the second dorsal fin, and is followed by eight or nine finlets: the tail is crescent-shaped; the membrane forming the lateral horizontal ridge on the fleshy portion of each side of the tail is produced, forming part of a circle.

All the upper part of the body of the Tunny is very dark blue; the scaly corselet being much lighter; the sides of the head are white; and the whole of the belly is greyish-white, with silvery white spots, which are prolonged towards the shoulders and flanks. The first dorsal fin, the pectorals, and ventrals, are black; the tail is paler: the second dorsal and anal fins are almost flesh-colour, glazed with silver; the finlets above and below are yellowish, tipped with black. The figure is taken from the plate of Cuvier and M. Valenciennes, who consider most of the previously-published representations of this fish to be more or less incorrect.

THE BONITO,

OR, STRIPE-BELLIED TUNNY.

Thynnus pelamys, Cuvier et Valenc. Poiss. t. viii. p. 113, pl. 214.
,, ,, Thompson, Nat. Hist. of Irel. iii. p. 94.
Scomber ,, *Bonito*, Linnæus. Couch's MS.
,, ,, ,, Jenyns, Brit. Vert. p. 363.

The Stripe-bellied Bonito, says Cuvier, resembles the Tunny in aspect, and is very different from the Bonito with a striped back, which belongs to the genus *Pelamys*. The stripe-bellied species takes a wide range in the Atlantic, from the Brazils and Bight of Benin to the coasts of Britain. It is the *Gaiado*, according to the Rev. R. T. Lowe, of the fishermen of Madeira, and the Bonito of the Cornish men, as mentioned in the manuscripts entrusted to me by Jonathan Couch, Esq. Dr. Scouler purchased a specimen in the Glasgow Market which had been taken in the estuary of the Clyde, and deposited it in the Andersonian Institution; and Dr. Fleming records an instance of the capture of the same species on the opposite side of the island in the Frith of Forth.

Mr. Thompson mentions, in his Natural History of Ireland, that a specimen was sent in a fresh state from the coast of Wexford to the Royal Dublin Society, where it is preserved, and Dr. Harvey, in his Fauna of Cork, notices the capture of another example at Kinsale in 1850. In August 1849, Mr. Bennett sent me a fine specimen which was taken in the meshes of a salmon-net, at Bennett's Court in the South of Ireland. This fish weighed nineteen pounds and a half, had a length of nearly thirty inches, and a girth of twenty-one inches behind the pectoral fins, which were themselves nine inches and three-quarters long. The first dorsal stood four inches and a half high and was seven inches and a half long: it folded into a groove, as did also the anal.

The Bonito is very similar to the Tunny in form, but is much smaller, seldom exceeding thirty inches in length. It inhabits the ocean, and is one of those species so well known to voyagers within the tropics for the amusement they afford by their pursuit of the Flying Fish. Sailors frequently employ themselves in catching the Bonito with a hook fastened to a piece of lead shaped like the body of a small fish, to which a pair of wings made of feathers are attached, to give it the appearance of a Flying Fish. The food of the Bonito is fish, small cuttles, testaceous animals, and even marine vegetables. Though eaten with avidity by those who have been previously confined to salt provisions, the flesh has been considered dry, and by some even is said to be disagreeable. This fish is subject to several sorts of intestinal worms.

Mr. R. Q. Couch says, "the striped Bonito has precisely the same habits with the Tunny. During the last summer, while sailing across Mount's Bay in 'a mackerel breeze,' going, perhaps, seven miles an hour, one of this species, easily recognisable by its belts, started into the

air after a flock of skippers, some way astern of us, and again fell into the water, but its course was marked by a continuous line of skippers, and in a few minutes it again sprung into the air just ahead of us, so that it travelled at a very rapid rate."—*Zoologist*, 1412.

A specimen obtained by Mr. Jonathan Couch on the Cornish coast "was twenty-nine inches long, and twenty inches round close behind the pectoral fins: the head is conical, ending in a point at the nose; the under jaw projecting; teeth few and small: tongue flat and thin; nostrils obscure, not in a depression; from the nose to the eye the distance was two and a half inches. The body was round to the vent, from thence tapering to the tail; near the tail it was depressed; the lateral line, at first descending and undulating, became straight opposite the anal fin, and ascending from thence terminated in an elevated ridge near the caudal. The small cutaneous crests on the side of the base of the caudal were distinct, one above and one below the lateral line. The eye elevated, and round; the iris silvery: from the nose to the pectoral fin was eight and three quarter inches; the pectoral fin was pointed, four inches long, and was received into a depression. First dorsal fin seven inches long, four inches high, lodged in a groove; the first two rays stout, the others low. The body is most solid opposite the second dorsal, which fin and the anal are falcate: caudal divided and slender; ventral fins in a depression. Colour, a fine steel blue, darker on the back; sides dusky, whitish below. Behind the pectoral fin is a bright triangular portion of the surface, from which begin four dark lines, that extend along each side of the belly to the tail. Scales few, like the Mackerel."

"This fish was taken in a drift-net in July, at which time the roe was abundant. It had no air-bladder; intes-

tines simple; the muscle the colour of beef, greatly charged with blood. It rarely takes a bait, and is too wary to be often taken in a net."—*Couch.*

Mr. Bennett's specimen, mentioned above, is described in the local newspaper the *Cork Constitution* of the 1st of Sept. 1849, as having, when newly taken, "a deep azure-blue colour on the back with shades of green, gold and crimson on the lower parts of the sides and belly, and four longitudinal stripes running along each side to the tail. The beauty of the colours, when fresh from the water, was indescribable."—*Quoted from Thompson's N. H. of Ireland.*

D. 15—1+12. VIII. : P. 27 : V. 1+5 : A. 2+12. VII. : C. 35.

The vignette below represents a mode of capturing fish commonly practised in the Brazils.

THE BELTED BONITO.

SHORT-WINGED TUNNY.

Thynnus brachypterus, Le Thon a pect. courtes, Cuv. et. Valenc. vii. p. 98, pl. 211.

Belted Bonito, Couch, Cornish Fauna.

Mr. Couch is the only naturalist who has had an opportunity of seeing a British example of this species, and it is introduced on his authority. It resembles, Cuvier says, the Common Tunny in the forms of its opercular bones, and in the numbers of its fin-rays, but it has much shorter pectoral fins and is on that account called *alicorti* in the Mediterranean.

D. 13—2+13—IX.: A. 2+12—VIII.: P. 31: V. 1+5: C. 19⅞.

This species, the *Histoire des Poissons* informs us, is confounded even by the fishermen with the Common Tunny. The above table of the rays in the fins, is quoted from that work, to which the reader is referred for a detailed description of the species. The size is seldom beyond three feet, and the dorsal bands are most conspicuous in the young fish. The above figure, reproduced from the second edition of British Fishes, will, it is hoped, assist observers in the discrimination of the different kinds of Tunny that visit our coasts.

THE GERMON.

Thynnus alalonga, *Le Germon*, Cuvier et Valenc. viii. p. 120, t. 215.
Germon, Barbot, Churchill's Voy. v. pl. 29 (1732).
Alilonghi, Duhamel, Pêches, pp. 203, 207.
Ala-longa, Cetti, Hist. Nat. Sard. iii. p. 191.
Orcynus alalonga, Couch (Jon.), MSS. fig.
Long-finned Tunny, Couch (R. Q.). Zool. 1413, with fig.

Cuvier considers it to be one of the most remarkable facts in the history of ichthyology, that this fish, of great size, very distinct in its characters, excellent as an article of food, and the subject of productive fisheries on the coasts of Europe, should have remained unnoticed by ichthyologists until a recent period. Though it is captured in abundance on the north coasts of Spain, facing the Bay of Biscay, and appears to be not uncommon on the French Atlantic coasts as high as Rochelle, it either rarely enters the English Channel, or it has been overlooked by British naturalists as much as it had been by those of Spain and France. It is to the Messieurs Couch, father and son, that we owe its introduction into the list of English fishes. Mr. R. Q. Couch informs us in the Zoologist for 1846 that two

specimens have been taken in Mount's Bay by fishermen who have spread their seines for Mackerel. One of them in the year 1846, whereof the published figure is quoted above, and the other, which was captured several years previously, was then deposited in the Penzance Museum of Natural History.

This fish ought to interest Englishmen peculiarly, since its appellation of *Germon*, by which it was first made known to science, is supposed to be a corruption of the word War-man, in use at the Ile d'Yeu, when the English were masters of Guienne and Poitou. The Basques name it *hegalalonchia*, which signifies long-winged, and the French mariners also, with reference to the length of its pectorals, call it *long-oreille* (long-ear). Cuvier had not the means of comparing Mediterranean with Atlantic specimens of this fish, their identity, therefore, rests on the accuracy of the details given in books. His description was drawn up from a specimen procured from Rochelle, and ought to accord with the British fish.

M. Noel de la Moriniere has given the best account of the fisheries of the Germon on the French Atlantic coasts. The fishermen of Ile d'Yeu begin the fishery in the south of the Bay of Biscay opposite St. Sebastians, follow the fish in their movements to the north of Belleisle; and the numbers they capture in a season average 13,000 or 14,000. They use lines of eighty fathoms in length, and bait their hooks with salted-eel, but the Germon being very voracious, a piece of white or blue cloth or some shining piece of earthenware, or tin cut into the form of a Pilchard, often serves the purpose.

The Germons arrive in the Bay of Biscay in numerous bands about the middle of June, sometimes a few come as early as May, and they continue to be met with as

late as October. Their fishery is generally two months later than that of the Tunny. The Germons prey on Mullets, Pilchards, Anchovies, and other fishes that assemble in sculls, and they also pursue the Flying-fishes. When the Germons come to the surface of the water, the fishermen take few, and large captures are only made at great depths. Experience alone points out the places where they may be sought with success, and when once the fishermen fall in with a scull of these fish, they pursue it till the end of the season. A cloudy sky, a fresh north-west or south-west wind, and a gently-agitated sea, are favourable for this fishery. When in full season, that is, in July and August, the meat of the Germon is whiter and more delicate than that of the Tunny, and fetches a better price, but before and after these months it is inferior. These details are borrowed from the *Histoire des Poissons*, wherein the history of the species is carried to a much greater length.

The specimen described in the Zoologist by Mr. R. Q. Couch was eighteen inches long and five high, excluding the vertical fins. The Germon has the usual form of the Tunnies, and a thickness equal to about two-thirds of its height. The falcate pectoral reaches as far towards the tail as the middle of the anal fin. The corselet composed of larger scales, commencing on the humeral chain, embraces the base of the pectoral, and extending as far as that fin reaches, forms a recess in which the fin lies when it is laid to the side of the fish. The formula for the fin-rays is—

P. 37 : D. 14—3+12, VIII. : A. 3+12, VIII. : V. 1+5 : C. 40.

There are three graduated spines buried in the front of the soft dorsal and anal, and eight detached finlets follow each of these fins. The ventrals are closely approxi-

mated to each other, and between them there is a slender scale which looks like an additional ray. The caudal fin is widely crescentic with very short rays towards the middle. The mouth is small, and the mandible is longer than the upper jaw. The teeth are small, and not thickly set on the jaws. On the palatines and tongue they are very short and densely villiform. The colour of the specimen was blackish-blue or deep mackerel tint on the dorsal aspect, fading on the ventral surface into pale blue, yellow, and white. These particulars are chiefly from Mr. Couch.

WINDMILL HILL, GRAVESEND.

Such scenes has Deptford, navy-building town,
Woolwich, and Wapping, smelling strong of pitch!

POPE.

THE PLAIN BONITO.

Auxis vulgaris, Cuvier et Valenc. t. viii. p. 139.
Scomber bisus, Rafinesque, p. 45, tab. 2, fig. 1.
,, *Rochei*, Risso, Ichth. p. 165, sp. 3.
Thynnus Rocheanus, ,, Hist. t. iii. p. 417, sp. 335.

Auxis. *Generic Characters.*—General form of the Mackerel, with the dorsals widely separated, but followed by more numerous finlets. Teeth minute. A thoracic corselet of larger scales. Tail keeled near the caudal.

In the last week of the month of June, 1839, two specimens of this handsome, mackerel-like Bonito, were received at Billingsgate Market, from the coast of Yarmouth, in Norfolk, where they had no doubt been caught by the nets then in active operation for the taking of Mackerel, the time being about the height of the season, when several miles in extent of netting are stretched out in the water. One of these examples passed into the possession of Mr. Pittman, a fishmonger of Leadenhall Market, the other was purchased for Mr. Groves, of Bond Street, and both were most kindly sent to me, from the interest these gentlemen took in the History of our British Fishes.

Mr. R. Q. Couch mentions two that were captured in Mount's Bay, one of which he saw, and has described in

the Zoologist (1412). It was taken at Newlyn Quay in July 1844. Another was captured off Yarmouth in September 1847, and is now preserved in the Museum of the Cambridge Philosophical Society.

M. Risso and M. Laurillard say this fish is named *Bonito* at Nice. In the great French work on the Natural History of Egypt, it is called *Maquereau unicolor*, with reference to its plain colour, as contrasted with the Striped and Belted Bonitos, and I have termed it the Plain Bonito.

The flesh of this fish is but little esteemed when fresh; it is therefore immediately either salted or pickled, which must be done with expedition, as the decomposition is rapid, and the fish becomes of a dark colour, almost black, if kept three or four days without salt. This I observed in one of the two specimens I received, when it was some days out of the sea. I found the flesh of both rather red in colour, and more solid or meat-like, than the flesh of fish in general; and neither when fresh boiled, nor afterwards when pickled, could I consider it better than a very coarse bad Mackerel.

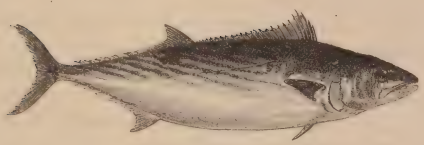
The females of this species are larger than the males, and deposit their spawn in August; the ova which are white are invested with a reddish albuminous covering.

The specimen here figured and described measured eighteen inches in length; four inches and a half in depth, and eleven inches and a half in girth, behind the first dorsal fin; the body in form being nearly cylindrical. The mouth is small; the under jaw rather the longest; the teeth are very minute, and are placed in a single row along the edges of both jaws; the eye is rather elongated horizontally, the anterior margin of the orbit being just over the angle of the gape; the irides are golden yellow; the cheeks and gill-covers smooth, the edges

rounded and entire; the first dorsal fin, the pectoral, and the ventral fins, have their origin very nearly on the same vertical plane; the first ray of the dorsal fin is two inches long, or rather shorter than the length of the base of the fin, which, when the rays are depressed, falls into a deep groove, wherein it is entirely hidden; the longest ray of the pectoral fin is of the same length as the longest one of the first dorsal, and behind each pectoral fin there is a shallow cavity in the side which receives the whole fin, so that its outer surface is on the same level with that of the body; the longest ray of the ventral fin is not quite equal to the length of the pectoral fin, and the ventral fins can also be shut in beneath a pair of indurated folds of the skin on the rim of the belly. The thorax and the parts around the pectoral and ventral fins are covered with small scales, forming a corselet (as shown in the figure), which terminates posteriorly in four points, of which one is on the mesial line of the back, one on each lateral line, and the fourth on the mesial line of the belly. The second dorsal fin begins rather before the anal aperture, and has behind it eight finlets; the anal fin commences under the end of the second dorsal fin, and has behind it seven finlets; the caudal fin is narrow, and crescentic, with a small lateral keel on each side.

D. 10—12—VIII. : P. 21 : V. 1+5 : A. 12—VII. : C. $17\frac{8}{7}$.

The back is irregularly mottled with two shades of indigo blue; the belly is silvery white; the corselet being rather darker than the belly, or greyish-white; the fins are darker grey, except the anal fin, which is tinged with yellow. The lateral line is not very strongly marked, and is lost behind the corselet. The upper surface of the head is bluish lead-colour; the cheeks and gill-covers are silvery.



THE PELAMID.

Pelamys sarda, La Pélamide,	Cuv. et Val. t. viii. p. 149, tab. 217.
,, *vera Aristotelis,*	Rondelet, 238. A.D. 1554.
Pelamis,	Salvian, 123. A.D. 1554.
Thunnus,	Aldrovand, 213. A.D. 1640.
Pelamys Belloni,	Willughby, 180. A.D. 1686.
Scomber ponticus,	Pallas, Zoogr. vol. iii. p. 217. A.D. 1831.
,, ,,	Bloch, 334.
Pelamys sarda, La Pélamide,	Webb et Berth. Can. Poiss. p. 50.
Scomber sarda, Bonetta,	Mitchill, New York Trans. vol. i. p. 428, No. 8.

Pelamys. *Generic Characters.*—The general shape of the members of this group is fusiform, and they have a cutaneous keel on each side of the slender part of the tail. On the coracoidal or pectoral region, scales of larger size form a corselet; elsewhere the scales are small and tender, passing, on the belly, into soft nacry integument. The dorsals are contiguous; and the first one has its rays, which are spinous, connected by a continuous membrane: behind the second dorsal there are numerous detached finlets, and one or two fewer behind the anal. The branchiostegals are seven. These, and other characters, they have in common with the Tunnies (*Thynni*); but they are distinguished by having longer and stronger subulate teeth on the jaws, widely set. The head is conical, with a rather fine apex formed by the symphyses of the equally long jaws.

This fine fish has a wide distribution, having been taken of full size on the Russian coasts of the Black Sea, in all districts of the Mediterranean, and on both sides of the Atlantic—on the east side from the Cape Verds and Canaries, northwards along the coast of Spain,

and on the west side off Connecticut, at New York, and on the Brazil coast. Ichthyologists might naturally have looked in the British seas for this active and wide-travelling fish, especially on the Cornish or Irish coasts; but the first of our naturalists who has had the fortune to procure a British example, or at least to recognise the species, is William Beattie, Esq., Honorary Secretary of the Montrose Natural History and Antiquarian Society. The specimen was captured in a salmon-net set at the mouth of the North Esk, which falls into the North Sea in latitude $56\frac{3}{4}°$, and fortunately came into the possession of a gentleman competent to understand the value ichthyologists set on such a discovery. Before intelligence of this fish reached us the entire impression of the third edition of British Fishes had been printed off; but as there had been no issue, we are enabled to interpolate this notice in the place that the species ought to occupy in the volume: and we beg to tender many thanks to Mr. Beattie and Dr. Gray for their communications; and to the directors of the Montrose Society for their liberality in lending the specimen.

According to Pallas, the Black Sea specimens attain the length of an ell; Webb and Berthollet's Canary example was twenty-five inches long; Storer quotes the dimensions of the New England ones at two feet; and Mr. Beattie's Forfar one measures twenty-two inches and three-quarters. These dimensions approach those of the Tunnies, and sailors very commonly confound the Striped Thynni and the Pelamids with each other under the general term of Bonitos; they also give them the name of Skip-jacks, expressive of the habit which many of the large Scomberoids have of skimming the surface of the sea, and springing occasionally into the air.

Pallas describes the Black Sea Pelamids as being variously clouded, on the upper parts, with brown and blue bands, while the under parts are silvery white and highly polished, and he adds that a blue stripe runs along under the lateral line. The branchiostegous membrane and the first dorsal are black, the pectoral fins azure-coloured—the purity of the colours and elegant form of the fish rendering it a very beautiful object.

The British Scomberoid to which the Pelamid has the nearest resemblance in external form is the Belted Bonito (p. 219), which has been detected in our seas by Mr. Couch alone: but that Thynnus has shorter teeth, and only thirteen spinous rays, in the first dorsal. In the Forfarshire specimen the following is the formula of the rays—

Br. 7: D. 21—1+13—viii.: A. 4+12—vi.: P. 24: V. 1+5: C. 21—20.

The spinous rays of the first dorsal are slender, and the third is the tallest, while the first is not above a sixth or a seventh part shorter. The figure shows the form of the fin, and how it falls off posteriorly. There is, perhaps, a short incumbent ray on the base of the second dorsal spine, but its existence cannot be proved without dissection, and it may be that the spine is merely thickened at the base. The numbers of the detached finlets behind the dorsal and anal vary with the age of the fish in the Scomberoids, the membrane being more continuous in the young, and including more of them. Four slender, graduated, jointless rays commence the anal. The pectoral is triangular, and when in repose, fits into a depression of the corselet. Its tip, when laid back, just passes the eighth ray of the first dorsal: and the ventrals, which also recline in a cutaneous depression,

have their origin opposite to the base of the first pectoral ray. The corselet composed of scales, larger and somewhat more conspicuous than the others, covers a triangular area on each side, which extends from the supra-scapula to a little beyond the point of the pectoral, where it ends rather obtusely. Its inferior edge is straight, and running along and near the under margin of the pectoral, joins the coracoid above the curve of the gill-cover. On the back the scales are very small, but sufficiently visible to the naked eye by reflected light, particularly a row or two under the spinous dorsal. They become gradually imperceptible on the sides, and are lost on the belly in the smooth nacry integument.

In the supra-scapular region, the lateral line bounds the corselet, receding from it over the proximal third of the pectoral, in a small curve convex upwards, then, before it passes the posterior third of the pectoral, resuming a straight course parallel to the back and nearer to its profile than to that of the belly. It makes, however, some slight undulations before reaching the region of the vent. Opposite the penultimate dorsal and anal free finlets, the lateral line is replaced by a callous cutaneous crest, which terminates at the base of the caudal. There are no oblique crests on the bases of the fin just named, such as the Common Mackerel possesses.

Both jaws are armed by conico-subulate teeth, rather widely set, with smaller ones springing up in some of the intervals. Most of these teeth are moderately curved, and the tallest ones arm the sides of the mandible; a pair, equally tall, however, stands on each side of the point of that bone, and rather more interiorly than the general row. On the premaxillaries the teeth are smaller and

closer. The palatine ones are strongly curved and rather crowded: there are none on the vomer.

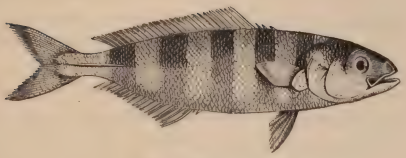
Ten dark bars traverse the back and upper half of the sides, descending below the lateral line. They run obliquely, the longest one extending from between the first and second free dorsal finlets to the apex of the corselet; the others lie parallel to it and at equal distances, and consequently, owing to the curve of the back, decrease in length the further they are situated from the one above mentioned. In the dried specimen the cheek is impressed by brownish grooves or wrinkles, intercepting elliptical areas, and similar depressions exist on the integument covering the coracoids. On the head generally, and especially on the jaws and gill-covers, the skin is very smooth, even, and nacry, without scales. The branchiostegous membrane and the isthmus of the gills are bluish-black. The first dorsal also appears to have been blackish. Including the caudal, the specimen measures twenty-one and three-quarter inches in length.

In the Zoologist for 1859 (p. 6731) mention is made of the capture, in a herring-net set off the coast of Banff, of an example of the Plain Bonito (*Auxis vulgaris*, p. 224 of this volume)—a fish which has hitherto been but seldom recognised on our coasts.

In the warmer districts of the Atlantic, Bonitos, Pelamids, and other large Scomberoids, are fished for with tackle rigged like a Mackerel line, but considerably stronger. The bait is a piece of bright tin, shaped like a Flying-fish, or a slice of the skin of pork, or the tail of a Mackerel. The hook is weighted so as to sink a little beneath the surface of the water, and produces most sport when it is dragged at the rate of five miles an hour, or thereabouts.

The Coracle is, perhaps, the most ancient model of a boat now in use, being as rude as it was when the Phœnicians first landed in Cornwall. Avienus, quoted below, described from Carthaginian annals.

"Notisque cymbis turbidum late fretum,
Et belluosi gurgitem oceani secant.
Non hi carinas quippi pinu texere,
Acereve norunt, non abiete, ut usus est
Curvant faselos : sed rei ad miraculum
Navigia junctis semper aptant pellibus,
Corioque vastum sæpe percurrunt salum."
(R. Fest. Avien. *Ora Maritima.*)



THE PILOT-FISH.

ROMEIRO, *Madeira.*

Naucrates	*ductor*,	Cuv. et Valenc. Poiss. viii. p. 312, pl. 232.
Gasterosteus	,,	Linnæus. Willughby, App. p. 7, tab. viii. fig. 2.
Scomber	,,	Bloch, pt. x. pl. 338.
,,	,,	*Pilot-fish*, Couch, MS.
Centronotus	,,	,, Jenyns, Brit. Vert. p. 365.

Naucrates. *Generic Characters.*—Members of the tribe of Scomberoids which have a first dorsal of isolated spines. Body fusiform; scales small, uniform, not forming a corselet, but towards the end of the tail having a tendency to become keeled on the lateral line. Head conical; small teeth on the jaws, vomer, and palatines. Branchiostegals seven. Spines of the first dorsal small, distant; second dorsal occupying much of the back; no spurious finlets; two preanal spines. No oblique crests on the base of the caudal, like those of *Thynnus* and *Scomber*.

The Pilot-fish has been so often seen on our southern coast, as to be entitled to a place among British Fishes.

This fish was placed by Linnæus in his genus *Gasterosteus* on account of the free spines anterior to the dorsal fin, but Rafinesque, referring it to a different family, called it *Naucrates*, and Cuvier adopted that name.

The Pilot-fish is thought by some to have been the *Pompilius* of the ancients; a fish which is said to have pointed out the desired course to bewildered navigators,

accompanied them throughout their voyage, and left them when they reached the wished-for land. The fish was therefore considered sacred, and was invested with a Greek name, πομπή, which signifies "a follower." Pliny, however, says, that this name was really given to young and banded Tunnies, which have also the habit of following ships.

Besides this practice of keeping company with a ship at sea for weeks and even months together, the Pilot-fish also attends large Sharks; but the motives of this association have been variously interpreted. Some have thought that the Pilot-fish acted as a guide to direct the Shark to his food; while others state, that when a Shark and his Pilot were following a vessel, if meat was thrown overboard cut into small pieces, and therefore unworthy the Shark's attention, the Pilot-fish showed his true motive of action by deserting both Shark and ship to feed at his leisure on the morsels.

M. Geoffrey relates an instance of two Pilots that took great pains to direct a Shark towards a bait. On the other hand, Colonel Hamilton Smith has furnished an account of an opposite character, which is thus related in Griffith's Animal Kingdom, Fishes, vol. x. page 636:—"Captain Richards, R.N., during his last station in the Mediterranean, saw on a fine day a Blue Shark which followed the ship, attracted, perhaps, by a corpse which had been committed to the waves. After some time a shark-hook, baited with pork, was flung out. The Shark, attended by four Pilot-fish, *Scomber ductor*, repeatedly approached the bait; and every time that he did so, one of the Pilots preceding him was distinctly seen from the taffrail of the ship to run his snout against the side of the Shark's head, to turn it away. After some further play, the fish swam off in the wake of the vessel, his dorsal fin

being long distinctly visible above the water. When he had gone, however, a considerable distance, he suddenly turned round, darted after the vessel, and, before the Pilot-fish could overtake him and interpose, snapped at the bait, and was taken. In hoisting him up, one of the Pilots was observed to cling to his side until he was half above water, when it fell off. All the Pilot-fishes then swam about awhile, as if in search of their friend, with every apparent mark of anxiety and distress, and afterwards darted suddenly down into the depths of the sea. Colonel H. Smith has himself witnessed, with intense curiosity, an event in all respects precisely similar."

With respect to this anecdote it may be observed that sailors often give the same name to totally different kinds of fish, and Cuvier has remarked that the *Remora* has been confounded with the *Naucrates*. Now Captain Richards' anecdote would apply to the *Remora*, which alone of the two fishes can and does adhere to the Shark.*

In the year 1831, two specimens of the Pilot-fish were caught on the opposite side of the British Channel, and more than one instance has occurred of their following ships into Guernsey. A few years since a pair accompanied a ship from the Mediterranean into Falmouth, and were both taken with a net. In January 1831, the Peru, Graham master, put into Plymouth, on her voyage from Alexandria for London, after a passage of eighty-two days. About two days after she left Alexandria, two Pilot-fish, (*Gasterosteus ductor*,) made their appearance close alongside the vessel, were constantly seen near her during the homeward voyage, and followed her into Plymouth. After she came to an anchor in Catwater, their

* At Jamaica the *Chætodon faber* is called the Pilot-fish.—*Sloane*, pl. 251, f. 4.

attachment appeared to have increased; they kept constant guard on the vessel, and made themselves so familiar, that one of them was actually captured by a gentleman in a boat alongside, though, by a strong effort, it escaped from his grasp, and regained the water. After this the two fish separated; but they were both taken the same evening, and, when dressed the next day, were found to be excellent eating. In October 1833, nearly one hundred Pilot-fish accompanied a vessel from Sicily into Catwater; but none of them were taken. In 1818 a Pilot-fish was captured while entangled in some sea-weed in Dartmouth Harbour. In November 1844, Dr. Shorter obtained a specimen at Hastings, and in the following month I received one from Mr. Groves, fishmonger in Bond Street. Mr. Charles Barron, the intelligent Curator of Haslar Museum, mentions that one was caught off Bembridge Ledge, in the Isle of Wight, in 1853, and on the morning of the 13th of January 1855, a boy named Eva, captured three from Green Bank Quay, Falmouth. A drawing of one of these was obligingly sent to me by W. P. Cocks, Esq.

The usual length of the Pilot is about twelve inches: the stomach has been found full of small fish: the flesh is delicate, and said to resemble that of the Mackerel. The fin-rays are:—

D. IV. 26: P. 18: V. 1+5: A. II. 16: C. 17.

The nose is rounded, the under jaw being rather the longest; the eye occupies one-fifth of the length of the whole head, and is placed at one-third of the distance between the nose and the end of the operculum; the irides are golden yellow; the nostrils are near the profile, and rather nearer to the point of the nose than to the eye; the mouth is not very deeply divided; the teeth very small, and numerous, form a band on each jaw, and a

narrow band on each palatine; one single, short, but strong tooth, stands on the front of the vomer, and there is one on the tongue; the tongue is large, thin, and free: the ventral fins are attached for one-third of their length to the belly by a membrane. The dorsal and anal fins end on the same vertical line.

The body is covered with small oval scales, except a triangular spot above the base of the pectoral fin; the cartilaginous keel-like projection on each side of the fleshy portion of the tail reaches from the origin of the caudal rays forward to before the last rays of the dorsal and anal fins.

The general colour of the fish is a beautiful marine blue, paler on the belly; the five blue transverse bands pass round the whole of the body, and are most conspicuous while the fish is in the water: there are also two fainter bands, one on the head, the other on the tail: the pectoral fins are clouded with white and blue, the ventrals are very dark.

THE DERBIO.

Lichia glaucus, Cuv. et Valenc. viii. p. 558, pl. 234.
Premier glaucus, Rondelet, p. 252.
Lampuge des Marseillais, Belon, p. 155.
Scomber glaucus, Linnæus.
Gasterosteus glaucus, Forster, Des. An. p. 5.
Centronotus vel *Lichia glaycos*, Risso, 2me Edit.
Centronotus binotatus, Rafinesque.
Albacore, Couch, Linn. Tr. xiv. p. 82. Jenyns, Man. p. 366.

Lichia. *Generic Characters.*—Form oval, compressed, covered with leathery scales, without keel or lateral ridges on the tail; head small; teeth minute. Dorsal spines low, isolated, each with an axillary membrane, and, in front of all, a recumbent spine; two preanal spines; second dorsal and anal long, similar to one another; no spurious fins. Seven branchiostegals. A large air-bladder, expanded posteriorly. Five conspicuous cranial ridges, the median one being the longest and highest.

Four species of this genus are described in the *Histoire des Poissons*, three of them inhabitants of the Mediterranean, but together with the fourth, ranging also along the western coast of Africa, some of them as far as the Cape of Good Hope, where the Dutch colonists call them *lyre-vish*. The species which we have to describe is the one which Rondelet says is known at Montpellier, by the name of *Derbio*, but which is called *La liche* and *La cabrolle* by the Provençals, and *La lechia* by

the Sards and Romans. At Nice its name is *lecco*', and, according to Rafinesque, its Sicilian appellations are *cionana*, *ciodena* and *ciodera*. Cuvier received specimens from various Atlantic localities, Algesiras, Madeira, Teneriffe, Goree, Ascension, Saint Helena, the Cape of Good Hope, and from Brazil, not to be distinguished from the Mediterranean ones. It may possibly be, as Forster intimates, the *Sea-blueling* or *Silver-fish* of the West Indies, but we have seen no example from that quarter. It occurs in the Rev. R. T. Lowe's list of Madeira fish, under the local names of *Ranhosa*, *Toonbeta*, and *Pelumbeta*, and is said to be extremely common at that island. It belongs to the same tribe of Scomberoids, with free dorsal spines as *Naucrates*, that is to the *Centronoti* of Lacépède.

Notwithstanding its extensive southern range, it seems to wander rarely into the more northern parts of the Atlantic. It is not mentioned by French ichthyologists as having been captured on the western coasts of their country; and Mr. Couch, to whose industry and acute discrimination British Ichthyology owes so much, is the only person who has procured an English specimen. That solitary example is carefully preserved in the Museum of the Natural History Society of Penzance, and we have not had an opportunity of seeing it, but through the kindness of Dr. Gray, of the British Museum, we have been enabled to compare two excellent photographs of the specimen with the figures given in the *Histoire des Poissons*, and in Webb and Bertholet's *Histoire Naturelle des Isles Canaries*. (Poiss. pl. 13.) With the latter the photograph agrees so closely as to leave no doubt of the specific identity of the fish they represent, and the former differs merely in the lateral line, being a little more undulated anteriorly. The lateral spots are not exhibited in the photograph, its prototype being, probably, too young

for the development of these markings. Cuvier regards the *Lichia tetracantha* discovered by Mr. Bowdich near the Gambia as merely a variety of this species, but from a drawing of *tetracantha* made at Sierra Leone by Dr. Mitchill, Surgeon in the Royal Navy, it appears to be a considerably more oblong species, and instead of about four spots on the fore part of the sides, it has a series of ten smaller ones, extending nearly to the base of the caudal. Its colour is bright ultramarine blue, and silvery white below, the lateral spots being darker blue, and the tips of the fins blackish-blue, as in *glaucus*. The true *glaucus* was also obtained by Dr. Mitchill, off the Niger in the Bight of Benin, and his drawing represents it as of a darker blue than *tetracantha*, and of a considerably deeper oval form. The following description of the Derbio is drawn up from the photographs with additions furnished by Mr. Couch.

This gentleman states the length of the specimen to have been thirteen inches and a half, and its height three inches and seven-eighths. The comparative length, omitting the acute caudal lobes, is thrice the height; and the head forms a sixth part of the total length, including the whole caudal fin. The scales are small, and not strong. The cheeks nacry and scaleless. The lateral line descends obliquely without an abrupt curve from the suprascapular, till it comes nearly over the first free anal spine, and a little above mid-height, and from thence runs straight to the central rays of the caudal fin without any keeling or armature perceptible in the photograph.

The fin formula is—

D. VI.—1 + 22: A. II.—1 + 23 or 24.

The ventrals and pectorals are both small. There is a couchant spine pointing forwards before the first dorsal, which is composed of six detached spines, all nearly of

equal height, and each with a triangular membrane in its axilla. The soft dorsal and anal are alike, each higher in front, but not decidedly falcate, and each has a short spine incumbent on the base of the first articulated ray. Two detached spines stand in front of the anal similar to those of the first dorsal, and midway between them and the ventrals is the vent.

The caudal is deeply swallow-tailed.

There are several vertical oval spots or bars in a row just above the lateral line, and touching it. These are said in the *Histoire des Poissons* to be peculiar to the adult fish. Mr. Couch says, that the dorsal aspect and the lateral bars were of rather a dark blue; the ventral aspect from the mandible to the caudal, and including the eye, was pale yellow, and the dark blotches on the anterior tips of the soft dorsal and anal were well marked. Cuvier describes the air-bladder as forked posteriorly, its long points entering among the muscles of the tail on each side of the anal interspinal bones: and he considers the course of the lateral line without a decided elbow as a mark by which the Derbio may be readily distinguished from the *Lichia amia*, which is the second *glaucus* of Rondelet, the *amia* of Salviani, and the *cerviola* of the Sicilians. In this second species the lateral line has a strong curvature in form of the letter ∽. Willughby introduced much confusion into the history of these two species, having mistaken the Derbio or the first *glaucus* of Rondelet for the second one; and Ray, Artedi, and Linnæus have all, while correct on some points, fallen into error on others in their accounts of the several species of Lichia.

THE SCAD, OR HORSE MACKEREL.

MACRELL, OR MEIRCH.—*Wales.*

Caranx trachurus, Cuv. et Valenc. Poiss. t. ix. p. 11, pl. 246.
Scomber ,, Linnæus. Bloch, pt. ii. pl. 56.
,, ,, *Scad*, Penn. Brit. Zool. vol. iii. p. 363, pl. 62.
,, ,, ,, Donov. Brit. Fish. pl. 3.
Trachurus vulgaris, ,, Flem. Brit. An. p. 218, sp. 163.

Caranx. *Generic Characters.*—Scomberoids with an oblong or suboval profile, and the lateral line cuirassed wholly or posteriorly only with keeled acute scales. Dorsals two, with a recumbent spine (interspinous bone) in front of the first one; the posterior rays of the second, and of the anal, loosely connected, in some separating into detached finlets. Two preanal spines. Teeth minute. Branchiostegals seven.

The Scad, or Horse-Mackerel as it is commonly called, in reference to its supposed coarseness and consequent inferiority, rather than to its size, is occasionally abundant on particular parts of our southern shore, and may be traced nearly all round the British coast. Communications from various sources will supply a better history of this species than any materials I could myself furnish.

This fish occurs on the coast of Antrim in Ireland, at Belfast Bay in the north, along the shore of the county of Cork in the south, and probably at many intermediate

points. Part of a letter from my friend Mr. Bicheno, residing on the coast of Glamorganshire, is as follows:—"On Tuesday, the 29th of July 1834, we were visited by immense sculls of Scad, or, as they are also called, Horse-Mackerel. They were first observed in the evening; and the whole sea, as far as we could command it with the eye, seemed in a state of fermentation with their numbers. Those who stood on some projecting rock had only to dip their hands into the water, and with a sudden jerk they might throw up three or four. The bathers felt them come against their bodies; and the sea, looked on from above, appeared one dark mass of fish. Every net was immediately put in requisition; and those which did not give way from the weight were drawn on shore laden with spoil. One of the party who had a herring-seine with a two-inch mesh was the most successful: every mesh held its fish, and formed a wall that swept on the beach all before it. The quantity is very inadequately expressed by numbers,—they were caught by cart-loads. As these shoals were passing us for a week, with their heads directed up channel, we had the opportunity of noticing that the feeding time was morning and evening. They were pursuing the fry of the Herring, and I found their stomachs constantly full of them."

According to Mr. Couch, the Scad "regularly visits the coast of Cornwall and Devon, commonly in scattered quantities, but occasionally in considerable sculls. The first appearance of this fish in spring is not until towards the end of April; it is not abundant before the warmer months of the year, when some may be found on board of every fishing-boat. It is rarely brought to market, and in many places even the fishermen are not in the habit of eating it: in the west of Cornwall, however, it is salted in the same way as Mackerel, and in this state meets with

a ready sale in winter. The usual habit of this fish is to keep near the ground; but when it assembles in pursuit of Sand-Launce, or other favourite food, as it sometimes does in innumerable multitudes, the crowd presses heaps on the beach.

"On a Tuesday evening, in August, upwards of ten thousand Scads were taken by a foot-sean near Marazion. These fish frequently come so near the shore as to enable persons to take them by hand. On Wednesday evening another scull appeared, when a number of men, women, and children went into the water to catch them, while others stood on the sand to see them throw the fish on shore; and by this means a vast quantity were obtained. The young keep near the shore after the larger fish have retired to deep water."—*Couch.*

Montagu found these species common on the Devonshire coast, and well known to the fishermen by the names before given. In one week, at the latter end of August, he obtained several, varying in length from three to fifteen inches; but the most common size was about nine inches. In West Bay and at Weymouth and off the Isle of Wight this fish is common. I saw about a score in the London market at the end of May 1834, and purchased two. They possessed a portion of the flavour of Mackerel, but were not so fine. These were about twelve inches long, and would have spawned about the same time as the Mackerel. They have been taken off Yarmouth, in Berwick Bay, in the Frith of Forth; and Dr. Fleming found part of one in the estuary of the Tay. Professors Reinhardt and Nilsson have ascertained their existence, also, as far north as the coast of Denmark and the west coast of Norway.

Montagu's description of a fresh specimen, fifteen inches long, is as follows:—"The depth behind the gills is three

inches; the mouth large; the upper lip capable of considerable projection; the teeth minute, not discernible without a lens; the eye very large, equal nearly to one-half the depth of the head, part silvery, part dusky; the operculum rounded; the last ray of the first dorsal fin connected by a membrane to the first ray of the second dorsal fin; the two spines anterior to the anal fin slightly united by a membrane to each other, and to the base of the first ray of the anal fin. The ventral fins are placed in depressions; the two spines and the anterior part of the anal fin are lodged in a groove. The curve of the lateral line is over the vent; the body from thence to the tail becomes quadrangular, on account of the bony plates of the lateral line, which are terminated by a spine pointing backwards, and forming a strong keel on each side quite to the tail.

"The number of fin-rays is as follows:—

D. 8—1+32: P. 21: V. 1+5: A. II. 1+26: C. 17.

"The colour is a dusky olive above, changing to a resplendent green, with a bluish wavy gloss; the sides of the head, and beneath the lateral line, silvery, with wavy reflections; dorsal fins dusky, the lower fins quite pale; on the margin of the gill-cover, above the pectoral fin, there is a large black spot: the throat and under part of the jaw is also black. This specimen was caught on a whiting-hook baited with Sand-Launce."

The Horse-Mackerels occur in many seas, with variations, however, in the number of lateral shields or keeled scales. In the Scad of our seas, the number of these lateral plates is seventy-four, but there are sometimes more, sometimes fewer.

THE SWORDFISH.

CLEDDYFBYSG, *Wales.*

Xiphias seu gladius, *Sword-fish*, SIBB. Scot. Ill. vol. iii. p. 23.
,, *gladius*, LINNÆUS. BLOCH, pt. iii. pl. 76.
,, ,, CUV. et VALENC. Poiss. t. viii. p. 255, pl. 225–6.
,, ,, *Swordfish*, PENN. Brit. Zool. vol. iii. p. 216, pl. 30.
,, ,, ,, FLEM. Brit. An. p. 220, sp. 169.
,, ,, *Common Sword-fish*, JENYNS, Brit. Vert. p. 364.
,, *Rondeletii*, LEACH, Wern. Mem. ii. p. 58, pl. 2, f. 1.

XIPHIÆDÆ. *Family Characters.*—Scomberoids having a remarkable prolongation of the snout, composed, for most of its length, of the vomer and premaxillaries, but supported, at its base, by the nasals, frontals, and maxillaries; the prefrontals interpose between it and the orbits and interorbital space. Dorsal fins long and high, but wearing down with age. Some have ventrals, others want them; none have detached finlets. Their intestines resemble those of the Tunny. (*Xiphiadini*, Bonap.)

XIPHIAS. *Generic Characters.*—Dorsal single in the old fish, appearing double from the wearing down of the middle rays, high and falcate in front; no ventrals; mandible much shorter than the snout, pointed. Branchiostegals seven. A cutaneous keel on each side of the tail. Branchiæ, each divided into two leaves which are connected to each other by transverse partitions, forming a wide-meshed sieve. Stomach cæcal, conical; pancreas complicated, and clustered as in the Germon. Air-bladder large.

THE SWORDFISH, an inhabitant of almost every part of the Mediterranean Sea, was well known to the ancients, and was called by various names, which had reference

either to its weapon, its supposed powers, its imposing appearance, or some other circumstance.* It was first figured by Salvian. In the Atlantic, like other Mediterranean fish, it appears to take a course near the land, either north or south, but seldom strikes far out towards the west. It has been taken at Madeira and on the coast of Africa; and in the opposite direction, on the coasts of Spain and France. Daniel, in his Rural Sports, states, that "in the Severn, near Worcester, a man while bathing actually received his death-wound from a Sword-fish. The fish was caught immediately afterwards, so that the fact was ascertained beyond a doubt."

"Ac durus XIPHIAS ictu non mitior ensis."
OVID, *Hal.* v. 67.

In October 1834, a party of gentlemen in their pleasure-boat fishing in the sea off the Essex coast, saw something bulky floating on the water at a short distance. On coming up with it, they found it to be a dead Sword-fish, ten feet long, of which the sword measured three feet: decomposition, however, was going on so rapidly, that a skeleton of the bones, which were entire, was the only portion that could be made available to any useful purpose.

Mr. Dillwyn, who has favoured me with many communications on Natural History, includes among them a notice of a Swordfish exhibited at Brighton in 1796, which had been caught off that coast; and the Rev. Robert Holdsworth sent me word that a Swordfish was taken in Bridgewater River in July 1834.

Mr. R. Q. Couch says that it is occasionally seen in Mount's Bay; and in October 1842, I received a notice

* From being cut to pieces at the place of its capture, Thurii, in the bay of Tarentum, it was called in the days of the Roman Empire, *Thomus Thurianus.—Plinius.*

of one having been killed near Sandwich Haven. "The Sword-fish was taken on the 20th by the crew of a six-oared galley belonging to Mr. Henry North, of the Fountain Inn of Deal. Mr. North was steering, and when near Sandwich beacon, seeing the fish in about four feet water, he directed the galley towards it. It was so exhausted, that the crew had little difficulty in passing a rope with a running noose round it, and, after playing it for some time, succeeded in raising it into the boat. Its total length was ten feet, and the sword measured to the front of the orbit, three feet five inches. The diameter of the eye was three inches and a quarter." A good pen-and-ink etching accompanied this notice. In the Zoologist for 1847 (p. 1911), Mr. Montford records the capture of one in Boston Deeps that was eight feet and a half long, the sword making two feet eight inches of that length: and in the same work (2928), Mr. Newton notes the capture of one in the year 1850 in the River Nen below Peterborough. The British Museum possesses the skin of one that was taken at Brighton.

The Swordfish was first noticed in our seas by Sibbald; since which Dr. Leach, Mr. Pennant, Dr. Fleming, Dr. Knox, and Dr. Grant have each had opportunities of examining specimens obtained in different parts of Scotland. Still farther northward there is scarcely a writer on Ichthyology but mentions the Swordfish, several having been taken in various parts of the Baltic.

The Swordfish is supposed to entertain great hostility to the Whale, and accounts of conflicts that have been witnessed are recorded by mariners. Captain Crow relates the following event as having occurred on a voyage to Memel:—"One morning during a calm, when near the Hebrides, all hands were called up at three A.M.

to witness a battle between several of the fish called Thrashers, or Fox Sharks (*Carcharias vulpes*), and some Swordfish on one side, and an enormous Whale on the other. It was in the middle of summer; and the weather being clear and the fish close to the vessel, we had a fine opportunity of witnessing the contest. As soon as the Whale's back appeared above the water, the Thrashers springing several yards into the air, descended with great violence upon the object of their rancour, and inflicted upon him the most severe slaps with their long tails, the sounds of which resembled the reports of muskets fired at a distance. The Swordfish, in their turn, attacked the distressed Whale, stabbing from below; and thus beset on all sides and wounded, when the poor creature appeared, the water around him was dyed with blood. In this manner they continued tormenting and wounding him for many hours, until we lost sight of him; and, I have no doubt, they in the end completed his destruction."

It is a commonly-received notion, that it is in consequence of mistaking the hull of a ship at sea for a Whale, that the Swordfish occasionally endeavours to thrust his sword-like beak into the vessel. Those who are on board on such an occasion, find it difficult to believe that the vessel has not struck against some rock unseen below the surface, so great is the violence of the shock, from the weight and power of the fish. Specimens of ships' planks and timbers, deeply penetrated by what appears to be the pointed upper jaw of a Swordfish, broken off by the concussion, are shown in various museums; but the forms and structure of these weapons indicate that, if they did belong to the Swordfish, various species, some of them attaining a very large size, must exist: some are evidently referable to the allied genus

Istiophorus, which is limited in its range to more tropical seas. Mr. Scoresby states an instance of a ship from the coast of Africa, the bow of which had been penetrated by a bone, which he took to be the snout of a Swordfish; and other instances are recorded.*

Captain Beechey says, "When in the Pacific Ocean, near Easter Island, as the line was hauling in, a large Swordfish bit at the tin case which contained our thermometer, but fortunately failed in carrying it off."

The Swordfish are said to go in pairs, and would probably be captured more frequently, but that their great wariness saves them. The mode of obtaining them, as practised in the Mediterranean, is reported to be still more amusing than that in use against the Tunny, which has been already noticed. A man elevated on a mast, or on a neighbouring rock, gives notice by signal of the approach of a fish. The fishermen row towards it, and make the attack with a small harpoon attached to a long line; and they are so skilful, as often to strike the fish at a considerable distance. The struggle which then commences is, in fact, Whale-fishing in miniature. Sometimes the captors are obliged to follow a fish for hours, before they are able to get it into the boat. The fishing season is from May to August.

The length of the Swordfish is from ten to twelve feet; but it occasionally attains a larger size, and has been known to exceed four hundred pounds' weight. Dr. Leach found small fish in the stomach of one: that examined by Dr. Fleming contained numerous remains of *Loligo sagittata*. The flesh of the adult is said to be hard but good; that of the young fish white, agreeable, and nourishing. At Genoa, young ones are sold and

* *Xiphiam* id est *Gladium*, rostro mucronato esse, ab hoc naves perfossas mergi in oceano.—*Plinius*, xxxii. 2. *Cnfr. Aelian*, xiv. 23.

eaten; but the elongated jaw is cut off before the fish are brought to market.

The fin-rays are,—

D. 3+40: P. 16: A. 2+15: C. 17.

Body elongated, nearly round behind, but little compressed; upper part of the head nearly flat, slightly descending to the base of the sword, which is formed by an extension of the vomer, maxillary, and premaxillary bones; the edges of the sword are produced, and finely denticulated; its extremity pointed and its upper surface finely striated, the under surface being smooth, with a slight groove along the middle. The sides of the head are vertical; the eye round; the nostrils placed near the upper surface, almost round, and close together, the posterior orifice being the largest: the mandible is pointed, and does not extend beyond the line of the curve formed by the facial profile as it descends from the cranium; the opening of the mouth extends backwards beyond the line of the eye; there are no teeth; the limbs of the mandible are only slightly rough, and a transverse membrane or velum lies within the mouth behind the symphyses of both jaws; there is no true tongue; the pharyngeal bones are furnished with very minute teeth, and the skin of the body is rough. The pectoral fins are elongated, and attached very low down; their first three rays are the longest, the last one the shortest; there is no vestige of ventral fins: the dorsal fin commences on a line with the gill-opening; its first three rays are spinous, the fourth or fifth ray is the longest: the rays then diminish rapidly in succession to the eleventh, where they have become very slender, and are connected by a very slight membrane as far as the thirty-ninth or fortieth. Through a great part of this length the dorsal fin is only about

half as high as the pectoral fin is long; the three or four last rays are rather longer. This is the state of the fin in a young fish, but the middle portion of the fin is so slight that it is easily torn, or even entirely worn away by use during life; and this will help to explain the representations of the adult fish, which exhibit only the extreme ends of this fin, making it appear like two dorsal fins separated. The lobes of the tail-fin are elongated.

The whole of the body is covered with a rough skin; the operculum is smooth; the lateral line scarcely visible; on each side of the tail there is a membranous keel. The whole of the underpart of this fish is of a fine pure silver colour, shaded with bluish-black on the upper part. Very young specimens of twelve or eighteen inches long have the body covered with small tubercles: these inequalities on the surface disappear as the fish increases in size, vanishing first from the back, afterwards from the belly, and, by the time the fish attains the length of three feet, they are no longer apparent.

As most of the works on Ichthyology contain a figure of the adult fish, in which the fins are worn, a young one, with perfect fins, has been selected for representation in the vignette below.

YOUNG SWORD-FISH.

THE BLACKFISH.

Centrolophus pompilus, Cuv. et Valenc. Poiss. t. ix. p. 334, pl. 269.
,, *morio*, Idem. ,, t. ix. p. 342.
Holocentrus niger, Lacepede, t. iv. p. 441.
Centrolophus ,, ,, edit. de Desm. pl. xcv. f. 3.
,, ,, *Black Perch*, Penn. Brit. Zool. vol. iii. p. 351.
,, *morio*, *Blackfish*, Lacep. Jenyns, Brit. Vert. p. 370.
Serran de Provence, Duham. Pêches, pl. vi. f. 2.

Coryphænædæ. *Family Characters.*—Thoracic scomberoids, with small scales, a long, compressed body, and the head trenchant above; a long dorsal supported by rays all nearly equally flexible, though the majority are not articulated. Vertical fins partially scaly. Teeth on the palatines, absent in some. (*Coryphenini*, Bonap.)

Centrolophus. *Generic Characters.*—Aspect somewhat sciænoid, head oblong, the forehead low compared to that of *Coryphæna*; eyes placed at mid-height; dorsal comparatively low and even, with a space between its front and the head in which the points of two or three interspinous bones project in fish that are out of condition; no teeth on the palatines: branchiostegals seven. Skeleton little indurated; vertebræ about twenty-five. Air-bladder very small.

Lacepede, when describing this rare fish, considered it to be unknown to naturalists. Mr. Couch has had the good fortune to see two specimens of it, which were taken in Mount's Bay, and one of them has been deposited in the museum of the Natural History Society

of Penzance. I avail myself of his kind permission to give his account in full.

"The specimen described was fifteen inches long; blunt and rounded over the snout, flattened on the crown; mouth small; tongue rather large; teeth in the jaws fine; nostrils double, that nearest the eye large and open; eye prominent and bright; five gill-rays: though soft, the membrane of the preoperculum had a free edge, somewhat incised. Body compressed, about three inches deep; a thin elevated ridge, on which the dorsal fin is seated, makes it appear deeper. This fin begins at four and a half inches from the snout, and reaches to the distance of twelve inches from it; the rays are fleshy at the base; many of them obsolete; vent six and a half inches from the lower jaw; pectoral fins pointed; ventral fins bound down by a membrane; tail forked; lateral line somewhat crooked at its commencement. Body covered with minute scales, which when dry appear curiously striated. Colour of the whole black, the fins intensely so, very little lighter on the belly; somewhat bronzed at the origin of the lateral line. While employed in drawing the fish, the side on which it lay changed to a fine blue. Another specimen measured two feet eight inches in length, and weighed nearly fourteen pounds. The skin was observed to be so tough that it could be stripped off like that of an Eel: no air-bladder was found.* The taste was delicious.

"This fish, first described as British by Borlase from the papers of Mr. Jago, of East Looe, has been a stumbling-block to naturalists for the greater part of a century. Stewart and Turton fixed it in the genus *Perca*, under the name of *P. nigra;* and Stewart supposed it was

* In the *Histoire des Poissons* this fish is said to have a very small slender air-bladder situated in the anterior third of the length of the belly.

a variety of the Ruffe, in which opinion he was joined by Dr. Fleming. All this, however, is to be traced to an original mistake of the Cornish historian, who, in copying Jago's description, represents it as three-fourths of an inch broad, which would make it as slender as a Tape-fish, where he should have read three or four inches, which were the exact dimensions of my specimen—a little more than three behind the head, a little less than four at the commencement of the dorsal fin, and the precise measurement of Jago's fish. The difference of colour in the four specimens now recorded as taken in Cornwall (Jago's two were caught in one net,) and those described by other authors, is easily explained by what is known to occur in reference to other species. The Tunny, like the *Pompilus*, is beautifully variegated in the Mediterranean Sea; but with us both of them assume an intense black.

"The great strength and velocity of this fish have been spoken of in terms of admiration by several authors; and the larger individual above mentioned, that fell into the hands of my friend Mr. Jackson, of East Looe, afforded a corroboration of the truth of the observation. It was caught in a net set for Salmon, at the mouth of the river, in the last week in November 1830; and such was the force with which it struck the bottom of the net, that it carried it before it over the head rope. Jago found oreweed in the stomachs of his fishes; Ruysch says they feed on seaweed, though chiefly on flesh; and in my own specimen were found a mussel without a shell, and a piece of a Sea Bream, *Pagellus centrodontus*, both, as I suppose, snatched as bait from the fishermen's hooks, but it was captured by a hook baited with the lask or slice cut from the side of a Mackerel."—*Couch.*

In addition to the six examples of this rare fish that

have been taken on the Cornish coast as mentioned above, the Rev. George Gordon states in a communication to the Zoologist (3459), that one fourteen inches long was caught at Lossiemouth in 1841. It was almost wholly black. Mr. Rudd also records in the same work (3504) the capture of one at Redcar in February 1852.

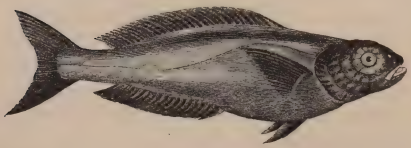
Cuvier and Valenciennes believe that the *C. pompilus* and *C. morio* are only different states of the same species; and as the descriptions and remarks of different authors go far to confirm their view, the two specific names have been brought together at the head of this subject. If, however, they should hereafter be considered distinct, the reader has here representations of both.

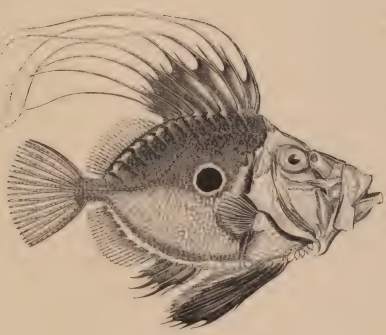
The woodcut at the head of this article is copied from that of *pompilus* by Cuvier and Valenciennes, and the vignette is reduced from Mr. Couch's drawing of his smaller specimen or *morio*. The name of *Centrolophus* was meant by Lacépède to express the projections of the nuchal interspinous bones.

D. 38: P. 20: V. 1+5: A. 22: C. 17.

M. Laurillard obtained a specimen, at Nice, twenty-seven inches long; and examples measuring thirty-two inches have been got.

YOUNGER BLACKFISH, DRAWN BY J. COUCH, ESQ.





THE DORY, OR JOHN DORY.

DORÉE, *France.*—SION DORI, *Wales.*

Zeus faber, LINNÆUS. BLOCH, pt. ii. pl. 41.
,, ,, CUV. et VALENC. Poiss. t. x. p. 6.
,, ,, *Doree*, PENN. Brit. Zool. vol. iii. p. 296, pl. 45.
,, ,, ,, DONOV. Brit. Fish. pl. 8.

ZEIDÆ. *Family Characters.*—Scomberoids with very protractile mouths, and feeble and not numerous teeth. Skin naked or clothed with small scales imbedded in the epidermis, without keels on the sides of the tail, but sometimes armed in the body by scattered bony shields. Allied to the Scomberoids by the cranial crests, their complicated pancreatic cæca and other parts of their internal structure. Body oval, high and compressed, surmounted by one or two dorsals, and with the ventrals mostly under the front of the spinous dorsal, in *Zeus* a little before the pectorals. (*Zeini*, Bonap.)

ZEUS. *Generic Characters.*—One dorsal deeply notched or two contiguous dorsals, anterior one spinous with filamentous tips taller than the spines; ventrals rather before the pectorals; anal spines four; caudal rounded. Bony dermal shields along the bases of the dorsal and anal. Branchiostegals seven. Stomach large, cæcal; air-bladder large, oval, simple.

The Dory was first described by Pliny; unless, indeed, it be the *Chalceus* of Oppian and Athenæus. The ancients must have entertained a high regard for it, since they gave it the name of Jupiter, *Zeus*.

The Dory contends with the Haddock for the honour of bearing the marks of St. Peter's fingers, each being supposed to have been the fish out of whose mouth the Apostle took the tribute money, and showing on the sides, as proof of identity, the impressions of his finger and thumb; the inventors of these legends not having considered it necessary that the Haddock or Dory should be inhabitants of the Lake of Gennesaret. Another origin for the spots on the sides of the Dory has also been assigned. St. Christopher, in wading through an arm of the sea, bearing the Saviour, whence his name of Christophorus, is reported to have caught a Dory, and to have left those impressions on its sides, to be transmitted to all posterity as an eternal memorial of the fact. The name of Dorée was therefore said to be derived from the French, *adorée*, 'worshipped.'

Our common appellation of John Dory is also said to be of foreign derivation, but in this case likewise with a reference to St. Peter. The fishermen of the Adriatic call this fish *il janitore*, 'the gatekeeper,' in allusion to the supposed keys of the gates of heaven, of which the Apostle is pictured to be the bearer; and in several countries of Europe the Dory is called St. Peter's fish. Whether this be the real origin of the English name for this fish may be questioned; and it is probably derived from the French, *dorée*, or *jaune dorée*, in reference to its peculiar golden-yellow colour. At what precise time the epithet of John became prefixed to the simple name of this fish, it may be difficult to ascertain: its name of Dorée is at least as old as Merrett, who, in his *Pinax*

Rerum Naturalium Britannicarum, 1666, speaks of it as a Dorée, or a Dorn.

The Dory is considered a rare fish in the north-western counties, but has been taken on the coast of Cumberland. In Ireland it occurs on the coast of Londonderry and Antrim; and, in the south, along the coast of Waterford. It is procured, on the Cornwall and Devonshire coasts, sometimes even in profusion; and, onwards to the east, on the Hampshire and Sussex shores; but on the north-east coast it is again considered rare. Mr. Paget says that several were caught during the summer of 1834 by the Yarmouth fishermen when taking Turbot on the Knowl. Dr. George Johnston has obtained this fish on the coast of Berwick, and Dr. Parnell says that one or two are taken every year at the mouth of the Forth, or on the sandy banks in Guillon Bay; but it is not mentioned by Low or Dr. Baikie among the Orkney fishes. Although the Dory is not included in the *Fauna Suecica* either of Linnæus or Retzius, nor in the *Zoologia Danica* of Müller; and it is considered that this fish does not go into the Baltic, or at least has not been caught there, yet Mr. Henry Kroyer gives it a place in his work on the Fishes of Denmark, which he had the kindness to send to me in October 1838.

The food of the Dory is the fry of other fishes, mollusks, and shrimps. The largest specimens that come to the London fish-market weigh from ten to twelve pounds; but the average weight is scarcely half as much. Pennant says the largest are from the Bay of Biscay.

Mr. Couch considers the Dory to be "rather a wandering than a migratory fish; and its motions are chiefly regulated by those of its prey. When the Pilchards approach the shore, the Dory is taken in considerable numbers. In the autumn of 1829, more than sixty were

hauled on shore at once in a net, some of them of large size, and yet the whole were sold together for nine shillings. It continues common until the end of winter; after which it is more rare, but is never scarce. The form of the Dory would seem to render it incapable of much activity; and it is sometimes seen floating along with the current rather than swimming; yet some circumstances favour the idea that it is able to make its way with considerable activity. It keeps pace with sculls of Pilchards, so that some are usually enclosed in the sean with them; it also devours the common Cuttle, a creature of vigilance and celerity; and I have seen a Cuttle a few inches in length taken from the stomach of a Dory that measured only four inches. It takes the hook, but gives the preference to a living bait; and a Chad,* hooked through the back, with the prickly dorsal fin cut off, is sure to entice it."—*Couch.*

"It is now," says Colonel Montagu,† "about sixty years since the celebrated Mr. Quin, of epicurean notoriety, first discovered the real merit of the Dory;‡ and we believe from him originated the familiar, and we may say national, epithet of John Dory, as a special mark of his esteem for this fish; a name by which it is usually known in some parts, especially at Bath, where Quin's celebrity as the prince of epicures was well known, and where his palate finished its voluptuous career."

"An ancestor of ours, a Mr. Hedges, was an intimate friend of Quin's, and was induced by him to take a journey from Bath to Plymouth, on purpose to eat John Dory in the highest perfection,—not only from procuring

* The young of the Sea Bream, *Pagellus centrodontus.*

† Colonel Montagu died in August 1815.

‡ Henry Fielding, the novelist, in his Journal of a Voyage to Lisbon, about 1755, says, "Detained at starting three weeks near the Isle of Wight by contrary winds; had Dory for dinner every day, and found them excellent."

it fresh, but with the additional advantage of having it boiled in sea-water, a matter of very great importance to the palate of Quin.

"As this journey was purposely taken to feast on fish, their stay at Plymouth was not intended to exceed a week, by which time they expected to have their skins full of Dory; but that no opportunity might be lost, Quin left strict charge with the host at Ivybridge to procure some of the finest Dory he could get, for his dinner on his return, fixing the day. Whether our celebrated epicure was disappointed in his expectations at Plymouth, is not recollected; but that he might have the provided fish at Ivybridge in the highest perfection, and remarking that the place was too remote from the coast to obtain sea-water for dressing the anticipated Dories, he ordered a cask of sea-water to be tied behind his carriage. Unfortunately, the weather had been stormy, and no fish of note could be procured. Every apology was made by the host, who assured him that an excellent dinner was provided, which, he had no doubt, would be to his taste; but no fish. The disappointment, however, was too great to be borne with patience; after having made a water-cart of his carriage, and the appetite having been set for John Dory boiled in sea-water, no excuse, no apology, would satisfy Quin; and he declared he would not eat in his house, but, like a ship in distress, threw his water-cask overboard, and pursued his journey not a little sulky, till some fortunate stroke of wit, or some palatable viand roused him to good humour. This western tour of Quin's did not appear to have given him much satisfaction, as may readily be imagined by his reply to a friend on his return to Bath. Being asked if he did not think Devonshire a sweet county,—'Sir,' said Quin, 'I found nothing sweet in Devonshire——but the vinegar.'"—*Montagu's MS.*

The body of the Dory is oval, very much compressed; the head large; the mouth capable of great protrusion,—so much so, that from the point of the lower jaw when extended, to the posterior angle of the operculum, is as long as from that angle to the base of the caudal rays. The length of the head when the mouth is not projected is nearly as long as the body measures in depth. The mouth is large; the teeth are small, placed in a single row in each jaw, and curving inwards; the eyes large, situated laterally, and high up on the head; the irides yellow; there is a spine behind and over each orbit about half way between the eye and the first ray of the spinous portion of the dorsal fin; the spines of the first dorsal fin are very long, the longest one half as long as the body is deep; the membrane between the spines ends in filaments three times as long as their respective rays. The base of the second dorsal fin is about as long as that of the first; its rays are flexible, and only half as high as those of the first: the pectoral fin is small and short, and reaches no further than the anterior edge of the dark lateral spot: the very long ventrals are slightly in advance of the pectorals, but their tips reach as far back as the first flexible ray of the anal; the first spinous ray of the anal fin is on a line with the posterior edge of the dark lateral spot, and with the sixth spinous ray of the dorsal; the flexible portion commences and ends nearly opposite the flexible dorsal: the tail is narrow, the lateral line is arched over the pectoral and dark lateral spot and posteriorly is straight. A row of spiny scales pointing backwards is ranged along the bases of the dorsal and anal fins on each side.

The number of fin-rays is—

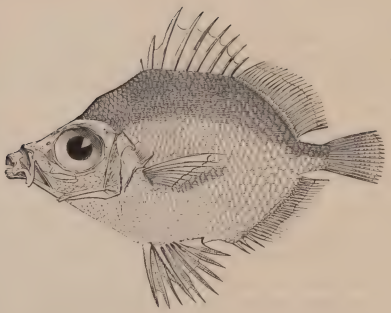
D. 9. 22: P. 13: V. 9: A. 5. 21: C. 13.

The prevailing colour of the body is an olive-brown,

tinged with yellow, and reflecting in different lights, blue, gold, and white; when the living fish just taken from the net is held in the hand, varying tints of these different colours pass in rapid succession over the surface of the body. The membranes of the flexible portions of the fins are light brown: those of the spinous portions are much darker.

A large portion of the Dories supplied to the London fish market are brought by land-carriage from Plymouth, and other parts of the Devonshire coast. Being a ground-fish, they are little or nothing the worse for keeping till the second or third day. Montagu, disliking the toughness of a fresh-caught Dory, says, it is most palatable after keeping two days. Fish for the supply of the London market was not brought by land-carriage until the year 1761. Steam boats seem likely to effect another change. In the summer of 1834, a cargo of Salmon from Scotland was deposited in the London market within forty hours.

SHRIMPERS.



THE BOAR-FISH.

LE SANGLIER, *France.*—STRIVALE, *Rome.*—TARIOLO, *Sicily.*—TINTA EMPÉ, *Madeira.*

Capros Aper, Lacep. Cuv. et Valenc. Poiss. t. x. p. 30, pl. 281.
,, ,, Yarrell, Proceed. Zool. Soc. 1833, p. 114.
Aper Rondeletii, Willughby, p. 296, p. T. iv. fig. 4.
Zeus Aper, *Boar-fish*, Linn. Jenyns, Brit. Vert. p. 308.

Capros. *Generic Characters.*—Dorsal so deeply notched that it may be described as two contiguous fins. Mouth more protractile than even that of *Zeus;* no spinous bucklers on the bases of the vertical fins, but the body is covered with very rough scales. Eye large. Two or three preanal spines. Branchiostegals from five to eight. Teeth very small. General form of *Zeus:* ventrals under the pectorals.

A specimen of the *Capros Aper* having been taken in Mount's Bay, in October 1825, a notice of the occurrence was forwarded to the Zoological Society, with a drawing and description, by Dr. Henry Boase; and in April 1833, another example being exposed in Bridgewater fish-

market, was purchased by Mr. William Baker, and kindly presented to me, together with a coloured drawing made of the fish while it was fresh. Having, also, had the use of three specimens belonging to the Zoological Society, sent from Madeira by the Rev. R. T. Lowe, I was enabled to introduce a figure and a description of this rare fish into the first edition of British Fishes. Since then other instances of the capture of the Boar-fish in the British Seas have been recorded in the Zoologist. Mr. Harvey, of Teignmouth, procured one on the Devonshire coast, and in 1839 one was caught and sent to the Elgin Museum (Zool. 3459). In March 1842, one was taken alive at Brighton, brightly-coloured orange and lake, and having been brought to Mr. Griffins, fishmonger, was by him carried to the Pavilion and presented to Her Majesty. A description and figure of this specimen was published by Waring Kidd, Esq., in the Zoologist (p. 191). Mr. R. Q. Couch, in the same work (p. 1417), mentions that a solitary Boar-fish was taken at Falmouth in 1841; that in July 1844, two hundred were enclosed and secured in a trawl-net off the Runnelstone in July 1844, and in July 1845 others caught in the same locality were exposed for sale in Penzance Market. They were cooked in a variety of ways, but Mr. Couch observes that they were not delicate eating. In June 1846, Mr. Cocks, of Falmouth, sent me a specimen, and in May 1850, Mr. Baker, of Bridgewater, obtained a second example of the species in the Bristol Channel. It was full of spawn. F. W. L. Ross, Esq., of Topsham, sent me a correct drawing of one taken on that coast in the summer of 1844, and in 1853 I had a letter from William Thompson, Esq., mentioning the capture of three off that place at three several dates. These numerous instances of its capture fully establish the Boar-fish to be a denizen of

our seas, though it had escaped the notice of our earlier ichthyologists.

The *Capros* was figured and described by Rondelet, who believed that it was the fish mentioned by Aristotle and Athenæus under that name, but Aristotle is speaking of a river-fish that emits a grumbling sound, which the Boar-fish is not known to do, so the correctness of this application of ancient nomenclature is by no means likely.

I am not aware of any figure of this fish from nature having been published previous to the first edition of British Fishes, except the original one given by Rondelet. The account of the species and its accompanying plate in the *Histoire des Poissons* were published subsequently. While referring to this subject, I may be excused for reminding the reader who possesses a copy of Rondelet's work, of the opportunity now afforded of comparing the woodcuts of fishes of the present time, with others cut in wood nearly three hundred years ago. Many of those contained in the work referred to, although coarse in their execution, are by no means deficient in character or spirit, but the name of the artist who engraved them at that early date has perished.

The form of the body is a shorter oval than that of the Dory; a band of minute teeth lies considerably within each jaw; the eye is very large, and is placed at the distance of its own diameter from the end of the nose when the mouth is shut; the nostrils are large, and situated just anterior to the edge of the orbit: the origin of the first dorsal, pectoral, and ventral fins is nearly on the same vertical plane; the base of the first dorsal is about as long as its third spine, which is the longest; the base of the second dorsal fin equals that of the first, its rays are very slender and flexible, the membrane only extend-

ing up one-third of their length; the pectoral fin is as long as the third ray of the first dorsal fin, and is slender and delicate in structure; the ventral fin has one strong spine, the other rays being flexible and branched, with the membrane falling short of their whole length: the anal fin has all the characters observable in the second dorsal fin, and ends at the same distance from the caudal; the caudal rays are slender, and twice as long as the fleshy portion of the tail. The number of fin-rays is,—

D. 9—24: P. 14: V. 1+5: A. 3+24: C. 12.

The lateral line is obsolete; the body is quite smooth when the finger is passed from before backwards, but very rough to the touch in the contrary direction, owing to its ciliated scales. The specimen belonging to the Zoological Society is five inches long from the point of the nose to the end of the tail; and the colour, which is probably altered from having been kept two or three years in spirit, is of a uniform pale yellowish-brown.

The specimen of this fish taken in Mount's Bay measured six and a half inches. Mr. Baker's example was seven inches long. In both these the irides were orange-coloured, and the pupil bluish-black; the upper parts of the back and sides were pale carmine, becoming lighter below, and passing to silvery white on the belly; the body was divided by seven transverse orange-coloured bands reaching three-fourths of the distance from the back downwards. The Mount's Bay specimen, according to Dr. Boase, had no bands. All the fin-rays were of the same colour with the back; their membranes being much lighter. Mr. Thompson, in his letter to me referred to above, mentions a bright silvery patch in the middle of the side with a scarlet border. This lateral spot has not been generally observed, and is not mentioned in the *Histoire des Pois-*

sons. It may be visible perhaps only at certain seasons, and is probably very evanescent; or it may have been a variation from the usual vertical orange bands.

In the Proceedings of the Dublin Natural History Society, April 9th, 1858, published in the Natural History Review for the following July, Mr. Andrews mentions the capture of an example of this fish off Ventry Harbour, on a fine sandy bottom. He states the colour of the back to have been a rich brownish-carmine, the sides brighter and more red and the belly silvery. The length of the specimen was six inches and a quarter.

GREENHITHE, ON THE THAMES.

Cæsar ad flumen Tamesin in fines Cassivellauni exercitum duxit: quod flumen uno omnino loco pedibus, atque hoc ægrè, transire potest.—De Bell. Gall. v. 18. (The earliest notice of the Thames.)

THE OPAH, OR KING-FISH.

Lampris guttatus, Chrysotose, Cuv. et Valenc. Poiss. t. x. p. 39, pl. 282.
Zeus Luna, Opah, Gmel. Linn. Penn. Brit. Zool. iii. pl. 46.
,, ,, ,, Donov. Brit. Fish. pl. 97.
,, *imperialis,* ,, Shaw, Nat. Misc. pl. 140.

Lampris. *Generic Characters.*—Body oval or ovate, compressed; scales very small and delicate, slightly keeled on the distal extremity of the lateral line. No teeth. Dorsal single, elevated, and falciform in front, low posteriorly and reaching near to the caudal; it has two small spinous rays: anal low, without a falciform elevation, and with only one spinous ray. Ventrals under the fore third of the dorsal, behind the pectorals, long and falcate, as are also the pectorals. Stomach cæcal, conical; pancreatic cæca above sixty in number, repeatedly forked; air-bladder very large, with two posterior processes. Branchiostegals seven.

The Opah, or King-fish, originally included in the genus *Zeus*, has been removed by some authors, on account of its possessing but a single dorsal fin; and the generic term *Lampris* has been applied to distinguish it.

This fish is as beautiful as it is rare. A rude figure of it in Sibbald's *Scotia Illustrata* (pl. 6, f. 3), published in 1684, is the first indication of its being an inhabitant of our seas. It is noticed by him in his description of the

plates, as an undescribed fish, ornamented with golden spots, and forty-two inches long. Pennant mentions in the first edition of his British Zoology, that five instances of its capture on our coasts had come to his knowledge—two in Scotland, one off Northumberland, one in Filey Bay, Yorkshire; and one at Brixham in Torbay in 1772, which measured four feet and a half, and weighed one hundred and forty pounds. To this the editor of the edition of that work, in 1812, adds that this handsome fish is not uncommon in the Orkneys, and that he had been informed by the Rev. George Barry of several having been driven ashore in the bays of Scapa and Kirkwall and on the island of Sanday. Dr. Baikie states more recently (1853) that upwards of a dozen specimens have been procured in the Orkneys, one of them measuring nearly six feet, having been taken by the late Wm. Strang, Esq., at Sanday. The Rev. George Gordon, in a list of the Fishes of the Moray Firth, published in the Zoologist (p. 3459), mentions that one about four feet long, and weighing one hundredweight, was cast ashore alive at Port Gordon, in March 1839, and that several years previously another was obtained at Nairn. Dr. Parnell, in his Essay on the Fishes of the Firth of Forth, informs us that several have been stranded in that estuary, the last one that he had heard of at the date of his paper having been thrown on the rocks near Queensferry, in July 1835. It weighed about eleven stone, and measured five feet. Its flesh was red, and the fishermen, who eat of it, thought it equal to salmon in richness and flavour. In the summer of 1839, I was informed by Lord Cole of a specimen having been taken that season in the river Dee, and in 1840 one captured in the Clyde was transferred to the Andersonian Museum in Glasgow.

Proceeding southwards in the enumeration of the places at which this fish has been taken, we come to the Yorkshire coast, and have to mention that towards the end of the year 1838 a fine specimen was caught on the Dogger Bank opposite to Burlington, and passed into the possession of Mr. Baker, a fishmonger of York, as recorded in the Naturalist. It is probably this specimen which exists in good preservation in the York Museum. In November 1850, a splendid example, of smaller size than usual, being under three feet and a half in length, and weighing seventy-two pounds, was obtained at Redcar as noticed in the Zoologist (p. 3010), by T. S. Rudd, Esq. In Paget's Natural History of Yarmouth, in Norfolk, an Opah is noted as having been obtained off that town in 1823, and another in 1828. In 1839, a specimen three feet long, caught at Hunstanton, was preserved by Mr. John Leadbeater of London, and is now in the Wisbeach Museum. The occurrence of a fourth example, on the shores of the same county, was communicated to the Zoologist (p. 679) in 1844, by J. H. Gurney, Esq., of Norwich. It was a male fish, weighing between four and five stones, and was left by the tide on the beach at Eccles, on the 6th of July. Its flesh was white with a tinge of yellow, and had a very sweet and rich taste. In August 1835, a specimen was intercepted by the weir-nets in the Bay of Llandudu near Conway, and since the publication of the first edition of British Fishes, Mr. Couch has ascertained the capture of one on the Cornish coasts. It would appear, from this enumeration, to be less common in lower latitudes than in the north; it has, however, been taken at Marseilles, Toulon, and Sicily, so that it enters the Mediterranean, and it is probably the *Peixe Cravo* of Madeira, though the Rev. R. T. Lowe speaks

doubtfully as to whether that is the *Lampris guttatus*, or a distinct species. It is not mentioned in Webb and Bertholet's *Histoire Naturelle des Isles Canaries*.

Some notices of its occurrence on the Irish coasts are given in the last edition of Thompson's Natural History. In Sampson's History of Derry, published in 1802, an engraving is given of one which was found on the flat shore at Magillagan. It was two feet long, ten inches high, weighed fourteen pounds, was green on the dorsal aspect, silvery on the ventral surface, the spots were bluish-white, and the fins scarlet. Dr. Burkitt of Waterford, in October 1842 obtained a specimen, which was captured near Tramore. It had a length of sixteen inches, a height of nine, the dorsal fin was eight inches high, and the ventrals seven inches long. Dr. Ball remarked that in this young individual the fins were proportionally longer than in any specimen or figure that he had previously seen. In June 1849 a specimen, weighing fifty-five pounds, caught at Innistrahull, was brought to the Derry Market. The fins were stated to be blood-red, and the spots black, yellow, red and gold-coloured. The annals of the Ordnance Survey state that one was caught in the Foyle in 1835; and Dr. Ball mentions that one, having a weight of fifty-nine pounds, was taken at Wexford in August 1849. In July 1850 a little boy secured one with his handkerchief as it was struggling on the sands off Whitehouse in Belfast Bay. This specimen is now in the Belfast Museum; and another, preserved in the University Museum of Dublin, was captured near the Skerries in 1851.

It is a fish not unknown in the northern seas. In 1762, Ström obtained it on the Norway coast, and in his account of it called it "a golden fish with silver spots." In 1768 it was again described and figured in the Memoirs

of Drontheim by Gunner, but badly named *Scomber pelagicus*. Brunnich, in 1788, noticed a specimen caught at Elsinore, under the appellation of *Zeus guttatus;* and in 1799 Retzius, describing in the Stockholm Transactions an individual taken at Helsingburg, first employed the generic appellation of Lampris. Professor Reinhardt mentions that within the thirty years preceding 1840 three examples have been procured on the Danish coasts, all of them in one locality.

It does not enter Professor Reinhardt's Fauna of Greenland, and it is worth noticing that none of the great group of Scomberoid fishes have been recorded as inhabitants of the icy seas. These fishes generally having more red blood, and in some respects a higher organization than others of their class, are probably impatient of very low temperatures, and their presence on the Norwegian coasts is due perhaps to the influence of the gulf-stream.

The fish resembling the Opah, which is represented in Chinese drawings, is most likely the *Mene maculata*, another member of the Dory family which inhabits the seas of Japan and China. The Dory itself is replaced there, and also in the Australian seas, together with *Capros*, by congeneric species distinct from the European ones.

The Opah was first described by Dr. Mortimer, in the Philosophical Transactions, from a specimen taken at Leith in the year 1750, and the preserved fish was exhibited at a meeting of the Royal Society. To his account of it Dr. Mortimer has added "that the Prince of Anamaboo, a country on the west coast of Africa, being then in England, recognised the fish immediately as a species common on that coast, which the natives called Opah, and said it was good to eat."

Little or nothing has been ascertained of the habits of

this fish: the stomach, of those that have been examined, contained Cuttle-fish and other Cephalopods, and *Acalephæ*.

The number of fin-rays is:—

D. 2+52: P. 28: V. 1+9: A. 1+25: C. 30.

The length of the body including the tail is to the depth of the body without the fins as two to one; the form of the body is oval; the profile of the head, both above and below, falls in with the outline of the body; the mouth is small, without teeth; the tongue thick, with rough papillæ pointing backwards, and well calculated to assist in conveying food towards the pharynx. The base of the dorsal fin is rather longer than the depth of the body, the first eight or nine rays are elongated, the longest being four times as long as the rays of the posterior portion; the pectoral and ventral fins are very long, being fully one-third the whole length of the body and tail; the anal fin, which is preceded by a triangular scale pointing backwards, equals in length half the length of the base of the dorsal; the caudal is lunate. The ventral, pectoral, and anterior part of the dorsal fins are falciform; the lateral line rises in a boldly-elevated arch to near the front of the dorsal, then descends behind the pectoral fin, to pass through the middle of the tail.

The upper parts of the back and sides are of a rich green with purple and gold reflections, passing into yellowish-green below; on the sides are various round yellowish-white spots, from which the fish received the name of *Luna;* the irides are scarlet; all the fins are bright vermilion.

The showy colours with which the Opah is ornamented induced one of Buffon's correspondents to remark, that it looked like one of Neptune's lords dressed for a court-day.

THE SCABBARD-FISH.

Lepidopus argyreus, Cuv. et Valenc. Poiss. viii. p. 223, pl. 223.
Vandellius Lusitanicus, Shaw, vol. iv. p. 99.
Xiphotheca tetradens, Montagu, Mem. Wern. Soc. i. and ii. pl. 2 and 3.
Lepidopus Lusitanicus, Leach, Zool. Misc. pl. 62.
Scabbard-fish, Penn. Brit. Zool. vol. iii. p. 210.

Gempylidæ. *Family Characters.*—Greatly-elongated scomberoids, without a corslet, no armature or keel on the lateral line, and no caudal crests; head low; teeth on the jaws compressed and pointed or lancet-shaped, the anterior premaxillary ones being longest; palatine and vomerine teeth present in some genera, wanting in others. Ventrals small, rudimentary or wholly absent. No scales, skin smooth. Branchiostegals seven or six. Stomach a long pointed sac. Includes the genera *Thyrsites*, *Gempylus*, *Lepidopus*, and *Trichiurus*. (*Trichiurini*, Bonap.)

Lepidopus. *Generic Characters.*—Form elongated and compressed like the blade of a straight sword, with the low spinous rays of a single dorsal extending from the nape to near the caudal; anal comparatively short: there are no detached finlets, and the three vertical fins are distinct; caudal small, crescentic at the end. Ventrals behind the pectoral region a mere squamoid cutaneous appendage, with the point of the styloid pubic bone, palpable through the skin. The palatine teeth are very fine. The vomer is toothless. Branchiostegals six. Air-bladder long and narrow.

Colonel Montagu first described the Scabbard-fish as a British species under the name of *Xiphotheca tetradens*, from its scabbard-like form and its four elongated teeth in front, believing it to be then entirely unknown to naturalists; but this fish is an inhabitant of the Mediter-

ranean as well as of the Atlantic sea, and has been taken occasionally in several different parts of southern and western Europe.

Gowan, Professor of Montpellier, in his Ichthyology, published in 1770, calls it the Garter-fish. One specimen taken at the Cape of Good Hope is described and figured by Euphrasen, in the new Memoirs of Stockholm for 1788, t. ix. p. 48, pl. 9, fig. 2; and other descriptions and figures are equally known. It has been taken in the Bay of Biscay, at Ushant, and at Rochelle.

Examples of it have also occurred on the southern shores of England, two of which fortunately came into the possession of Colonel Montagu, and are still preserved in the British Museum. In the summer of 1787, a specimen came ashore near Dawlish; and notes with a drawing of it were sent by Mr. Matthew Martin to his friend and correspondent John Wallcott, Esq., for his then projected work on British Fishes. A fourth example was received a few years back by the Linnean Society.

Since that time, Mr. Couch has informed me of one caught off the Cornish coast by the fishermen of a boat from Mount's Bay: notices of two others taken off the Devonshire coast have been sent to me; and F. C. Lukis, Esq., of Guernsey, forwarded to me in February 1838, an account of the capture of one there.

Colonel Montagu's first and largest specimen measured five feet six inches in length; the depth at the gills was four and a half inches, and the weight, without the intestines, six pounds one ounce. This fish was taken in Salcombe Harbour, on the coast of South Devon, in June 1808. It was swimming with astonishing velocity, with its head above water,—to use the fishermen's expression, "going as swift as a bird,"—and was killed by a blow of an oar.

"The specimen was considered so rare, that a public show was made of it at Kingsbridge, where, in one day a guinea was taken for its exhibition, at one penny each person. It was embowelled when I first saw it. In preparing it, I observed within the skin, on the abdominal parts, a great many small ascarides, pointed at each end, and of a whitish colour: they were all coiled up in a spiral manner. On the head beneath the skin, and along the root of the dorsal fin, were several of a species of *Echinorhynchus*, of a yellow colour, nearly two inches in length, and more than one-eighth of an inch in diameter: the proboscis short, with a round termination furnished with spines: the anterior end of the body sub-clavate, with a groove on each side: posterior part wrinkled, and obtusely pointed. These *vermes* had formed sinuses under the skin, and were firmly attached by one end."—*Montagu.* This fish has been observed by other authors to be infested with worms.

Not to multiply the description of Montagu, an abridgment of that of Cuvier is here given.

The head is pointed and slender; the edge of the back thin; the dorsal fin low, extending all along the back, and supported by rays of nearly equal length throughout; the edge of the belly is rounder, and has but a short anal fin at the posterior end; the caudal is small and concave. The remarkable characters of the fish are, the pointed and cutting teeth, the two rounded scales in the place of ventral fins, and a third triangular scale situated behind the vent. These are the only scales, for the skin is smooth.

The head is about one-seventh of the whole length of the fish, and in height about equal to half the length of the head; the thickness of the body is one-fourth of its height. The eye is placed about half-way between the end of the lower jaw, which is the longest, and the hinder

edge of the gill-cover; the nostrils are ovate, and are just before the eyes. Each premaxillary bone has a row of twenty or twenty-two compressed, cutting, sharp-pointed teeth: in front, just within the margin of the bone, there are two to three teeth four times as broad and as long as the others, slightly bent inwards; six of these are the normal number, but two or three of them are generally broken off. The mandible has also one entire row of teeth, with two longer ones. The vomer is not armed with any teeth, but the long external edge of each palatine bone has one row of very minute ones; the pharyngeal bones and the branchial arches are also set with extremely minute teeth.

The pectoral fin is equal in length to about one-fifteenth part of the whole body, and its lower rays are the longest; the two upper rays are short and simple, the other ten rays are branched and articulated. The two semi-circular scales in the place of ventral fins are situated rather nearer the tips than to the roots of the pectorals, and are connected to each other at the base. The dorsal fin commences at the nape; its height is one-fourth of that of the body, and its rays are simple and flexible. The vent is at an equal distance from each extremity of the fish, and has a movable triangular scale behind it. The anal fin commences far behind that scale; the tail becomes very slender between the three vertical fins, and the caudal fin, which terminates it, is small and crescentic at the end; all the membranes of the fins are delicate and easily injured. The lateral line is a narrow depression, which, descending gradually from the upper edge of the operculum, afterwards passes along the middle of the body and tail.

The irides are silvery, the fins greyish-yellow; the colour of the skin, which is quite smooth and destitute of

scales, is like burnished silver, with a bluish tint. The fin-rays are—

D. 105 : P. 12 : A. 17 : C. 17 : vertebræ 111.

The variations in the number of fin-rays, according to the enumeration of different authors, leads to the supposition that more than one species will yet be defined.

The flesh, according to Risso, is firm and delicate. The females are full of ova in spring; they approach the shore in May.

A very young specimen of this fish was found alive on the shore in Slapton Bay, on the south coast of Devon, about four miles east of the Start Point, in February 1810. "I regretted," says Colonel Montagu, "not having seen it alive; but it was quite fresh and perfect when brought to me the day after it was taken, and is now in high preservation in spirits. It measures about ten inches in length, and half an inch in breadth, at the broadest part, just behind the head, and where its thickness does not much exceed one-eighth of an inch. It differs in nothing but size from that before described: the characteristic larger teeth are conspicuous, and the two ventral scales are also obvious by the assistance of a glass: the dorsal and anal fins are so fine in this young specimen, and lie so close, that they are not easily discovered, unless they are lifted up by some pointed instrument: the caudal fin is very small, but perfect: the under jaw projects full as much in proportion as in the larger fish: the whole skin is covered with a silvery cuticle, which is easily sparated by gentle friction, and adheres to the fingers; it is not of that high polish observed in some of the scaly fishes, and is a little wrinkled; there are also several slight longitudinal depressions on the sides, that give a striped appearance in some points of view.

"How are we to account for this very young specimen

being found in our seas, unless the spawn had been deposited on our coast? And if, as we may now conclude, this fish actually inhabits our seas, it is curious that it should never before have been discovered."

This small specimen is still in good preservation at the British Museum, the depositary of Montagu's collection of fishes and shells, as well as of his birds; and the annexed vignette represents its head and shoulders of the natural size.

YOUNG SCABBARD-FISH.

THE SILVERY HAIRTAIL.

Trichiurus Lepturus, Linnæus. Bloch, pt. v. pl. 158.
,, ,, Cuv. et Valenc. Poiss. t. viii. p. 237.
,, ,, Hoy, Linn. Trans. vol. xi. p. 210.
,, ,, *Blade fish*, Flem. Brit. An. p. 204, sp. 115.
,, ,, *Hair-Tail*, Jenyns, Brit. Vert. p. 372.

Trichiurus. *Generic Characters.*—Head and body and dentition of *Lepidopus*, but without a vestige of ventral fins; tail ending in a single elongated hair-like filament, without a caudal fin; anal fin merely a series of spines, which scarcely penetrate the skin.

Two specimens of *Trichiurus* having been found dead on the shore of the Moray Frith, were examined by Mr. James Hoy, of Gordon Castle, a Fellow of the Linnean Society, and an account of them published in the Transactions.

"On the 2nd of November 1810, after a high wind from the north, a specimen of the *Trichiurus lepturus*, Linn. was cast upon the shore of the Moray Frith, near the fishing village of Port Gordon, about three miles east from the mouth of the river Spey; and it was brought to me the next day, as a kind of fish which had never been seen before by any of the fishermen in this part of the

country. They said, that in seeking for lobsters cast ashore by the storm, they found it lying dead upon the sandy beach."

"Its head was much broken, probably by being dashed upon the rocks above low-water mark; the bones of the upper part of the head still remained, and the sockets of the eyes were distinguishable, very near to each other: the extremity of the upper jaw, or upper part of the mouth, was entire; upon either side of which was an operculum. The length of the head could not be measured exactly, but was about eight or nine inches; the body, from the gills to the point of the tail, was three feet two inches long; its greatest height six inches and a quarter, and its greatest thickness only an inch; the vent was two inches from the gills;* these were much broken, and partly gone, so that the number of the rays could not be ascertained. Both sides of the fish were wholly white, without a spot upon them; the dorsal fin was the only part of a different colour, being a blackish-green; this fin ran all along the back from the gills to the tail, consisting of a great number of rays, soft, and little more than an inch long. Each of the pectoral fins had six double rays. There were no ventral nor anal fins; but the belly was a sharp, smooth, and entire edge. The tail ended in a point, consisting of three or four soft spines or bristles of different

* The forward situation of the vent proves that this fish could not have been the *Vaagmaer*, which has that orifice in the middle of its length, and the great compression of the body reducing the thickness to less than one-fifth of the height, even if Mr. Hoy had included the dorsal rays in his measurement, does not agree with the account of *T. lepturus* in the *Histoire des Poissons*, where the thickness of *lepturus* is said to be one-fourth of its greatest height. Another discrepancy is in the sharp smooth entire edge of the under profile in Mr. Hoy's fish, that gentleman not being likely to have overlooked the anal spines, which, to the number of about one hundred and eighteen, just penetrate the skin. The three or four soft bristles which terminate the tail are also unlike the long tail of *lepturus*, which is a narrow tape-like filament.

lengths, not exceeding two inches. The body was nearly of the same breadth for one-half of its length, and then its breadth diminished gradually till within three inches of the tail, when the diminution became more quick. The lateral line was straight, and strongly marked along the middle of the two sides.

"This was the first individual of the genus *Trichiurus*, as far as I know, that had ever been thrown on the British coast. But although the fishermen have not found out the means to catch them, it now appears that these fish inhabit our seas; for on the 12th of November 1812, another of them, of a much larger size, was cast on the beach, hard by the same fishing village as the former: it was brought next day in a cart to the Duke of Gordon, at whose desire I made the following observations:"—

"Its head had been broken off, and was quite gone; a small bit of the gills only remained about the upper part of the throat; from whence to the extremity of the tail its length was twelve feet nine inches: its breadth, eleven inches and a quarter, was nearly equal for the first six feet in length from the gills, diminishing gradually from thence to the tail, which ended in a blunt point, without any of those kind of bristles which projected from the tail of the one found formerly: its greatest thickness was two inches and a half: the distance from the gills to the anus forty-six inches. The dorsal fin extended from the head to the tail, but was much torn and broken: the bones and muscles to which the pectoral fins had been attached, were perceivable very near the gills. There were no ventral nor anal fins; but the thin edge of the belly was closely muricated with small hard points, which, although scarcely visible through the skin, were very plainly felt all along it. Both sides of the fish were white, with four longitudinal bars of a darker colour; the one immediately

below the dorsal fin was about two inches broad, each of the other three about three-fourths of an inch. The side line straight along the middle."

Dr. Fleming has remarked, that "from the preceding descriptions it appears probable that the two fishes examined by Mr. Hoy belong to different species. The difference in the position of the vent, the structure of the tail, and the condition of the ridge of the belly, seem too great to justify the inference of their being only varieties. The latter fish appears identical with the *lepturus* of Artedi, and consequently of Linnæus."

Cuvier and M. Valenciennes, in their description of *T. lepturus*, state the situation of its lateral line to be but one-third of the height of the body above the edge of the belly: Mr. Hoy says that the side line went straight along the middle: in other respects, Mr. Hoy's second fish agrees nearly with *T. lepturus*, as described in the *Histoire Naturelle des Poissons*, already referred to. It would seem, however, that it must have been comparatively a deeper fish: the barring of the sides does not occur in *T. lepturus;* and the latter has never yet been recorded as arriving at the gigantic size of Mr. Hoy's specimen, which could not have been less than fourteen feet and a half in length; the largest in the Paris Museum is stated to measure only three feet. It is evident that more information on the subject is required: the result of it may be the establishment of Mr. Hoy's second fish as a new species of *Trichiurus*, and of his first fish, which is evidently distinct from the second, as the type of a new genus,—if it was not, as Dr. Fleming has suggested, a mutilated example of the Dealfish of the Orcadians, *Gymnetrus arcticus*, the fish next described in this work.

Specimens of *Trichiurus* have been taken at New York,

Cuba, Jamaica, Porto Rico, St. Bartholomew's, Cayenne, Rio Janeiro, and Monte Video. Cuvier thinks it may cross the Atlantic; and adds, that specimens received from Senegal in no way differed from those received from America.

Several species inhabit the Indian Seas, and all are truly marine. The work of Cuvier and M. Valenciennes contains the characters of three species,—*lepturus*, *haumela*, and *savala*. Mr. J. E. Gray has published the characters of three species in the collection at the British Museum, under the names of *armatus*, *intermedius*, and *muticus*, in the first part of his Zoological Miscellany, pages 9 and 10; and representations of three species will be found in that part of the Animal Kingdom, by Edward Griffiths, Esq. and others, which is devoted to Fishes, plate 9.

The number of fin-rays in *T. lepturus* is—

D. 135 or 136: P. 11.

Mr. Hoy remarks, that as the second fish appeared to be very fresh, a cut of it was broiled, which he found to be very good, approaching nearly in taste to the Wolf-fish, *Anarhichas lupus*, which he had an opportunity of tasting only a few days before.*

The figure at the head of the present article, which will assist an observer in determining correctly the true *Trichiurus lepturus* in the event of its occurring on the coast, is copied from Bloch: and subjoined is an abridged description of the species from the work of Cuvier and M. Valenciennes.

The height of the body at the deepest part is to the

* A note, written with a pencil by Mr. Yarrell, in the margin of his own copy of British Fishes, makes a reference to a letter from Mr. Holdsworth relative to a *Trichiurus* taken at Brighton in the spring of 1841, but the letter itself is missing.—Ed. 3rd Ed.

whole length, reckoning from the point of the nose to the end of the hair-like tail, as one to sixteen or seventeen: at mid-length the body begins to diminish, and continues declining in size, the latter fifth portion being merely the slender tail: the length of the head, from the proximal extremity of the mandible, to the end of the operculum, is equal to one-eighth of the whole length of the body; the descending line of the profile from the nape to the nose is straight; the face and crown are flat, the side of the head vertical: the eye is placed high up near the line of the profile, the posterior edge of the orbit dividing the length of the head, and the diameter of the orbit is one-sixth of the whole head: the nostril is oval, and near the anterior edge of the orbit: the mouth is furnished on each limb of the jaws with a single row of about fifteen teeth, compressed, cutting, and pointed; of which those towards the front are the smallest, except that there are two on each side of the upper jaw long and curved with a slight barb, and two or three rather longer than the others on the mandible: the vomer is without teeth, but the palatine bones have each a row of very minute teeth, more easily felt than seen; the tongue is long, pointed, free, and perfectly smooth: the edge of the preoperculum forms a half-circle.

The pectoral fin is small, and not so long as the body of the fish is deep; the second and third rays are the longest of the eleven rays in the fin; there is no vestige of ventrals: the dorsal fin commences above the superior angle of the operculum, and its rays are uniform in height throughout the greater part of its length, diminishing a little towards the end: the anal orifice is situated at one-third of the length of the fish from the head; behind it are numerous small spiny points, to the number of one hundred and fifteen, or one hundred and

eighteen. No scales are visible, but the skin is covered with a delicate silvery membrane: the lateral line, commencing at the upper edge of the operculum, descends to the level of the lower third of the body, and continues at that height to its termination.

The colour of the fish is a bright and shining silver-white: the fins greyish-yellow; the edge of the dorsal is speckled with black, forming a spot between the first rays: the irides are golden.

SUNDERLAND HARBOUR.

Illi robur et æs triplex
Circa pectus erat, qui fragilem truci
Commisit pelago ratem
Primus. HORATIUS.

THE VAAGMAER, OR DEAL-FISH.

Trachypterus Bogmarus, Cuv. et Valenc. Poiss. t. x. p. 346.
Gymnogaster arcticus, Brünnich, Kong. Danske. Bid. Selsk. Kiobenh. 1788, t. B. f. 1-3.
Bogmarus Islandicus, Schneider, p. 518, pl. 101.
Gymnetrus arcticus, *Vaagmaer*, Flem. Mag. Nat. Hist. iv. f. 34.
" " *Dealfish*, Jenyns, Brit. Vert. p. 372.
Vogmarus Islandicus, Reinhardt's *Vaogmære.*

Tæniædæ. *Family Characters.*—Sword-shaped or tape-like fishes with a smooth nacry epidermis containing delicate microscopical scales, and bands of soft or hard tubercles in the subjacent skin ; in some there are rows of superficial bony shields. Dorsal occupying nearly the whole length of the back, generally with elevated rays in front. Caudal varying with the genus. Anal absent. Ventrals subbrachial, in some small and of six rays, in others very long and consisting of only one or two rays. The rays of all the fins are fragile, and the jointed ones are unbranched. Mouth small and protractile. Skeleton fibrous, but with little compactness and easily injured. Stomach forming a sac-like cone below the pylorus; pancreatic cæca very numerous. No air-bladder.

Trachypterus. *Generic Characters.*—Body like the blade of a broad two-edged dagger, fringed entirely above by the dorsal fin, whose front rays rise on the nape like a tall slender fan. Upper lobe of the caudal similar to the front of the dorsal, and nearly vertical ; lower lobe containing a few short bristles, and between the lobes a short filament. Vent in the middle of the length. Lateral line protected by small shields, each having a hooked boss. Jaws furnished with visible teeth. Branchiostegals six or seven.

Dr. Fleming published, in the Magazine of Natural History, an account and description of this interesting addition to the catalogue of British Fishes, and he

appears to be the only British naturalist who then knew of its occurrence in Scotland. The specimens he obtained, however, were either so mutilated, or so imperfectly preserved, that he was induced to doubt the propriety of considering the species to be a *Gymnetrus*, and proposed to replace it in the genus *Gymnogaster* of Brünnich.

A recent notice of the Vaagmaer, or Vaogmære, as it is called in Scandinavia, appeared in the *Institut*, or, *Journal Général des Sociétés et Travaux Scientifiques* (t. ii. 1834), of which the following is a free translation :—

"Professor Reinhardt states, in his Ichthyological Memoirs communicated to the Royal Society of Natural History and Mathematics of Denmark, that the Ichthyologists of the North have inaccurately described the *Vogmarus Islandicus;* their specimens having been mutilated, or badly preserved. A specimen, almost entire, was thrown ashore during last year on the coast of Skaagen, which is now in the zoological collection of the university : another was caught at the Feröe Islands, and is preserved in the Royal Museum. These specimens have been carefully examined, and prove that the Vaogmære does not belong, as Linnæus believed, to the apodal fishes, but to the thoracic ; although neither of these two specimens are sufficiently perfect to admit of the measurement of the fin-rays." This northern species differs from those of the Mediterranean.

In Dr. Fleming's paper above referred to, one specimen caught alive at Sanda, in Orkney, is thus described : —"Length three feet; body excessively compressed, particularly towards the back, where it does not exceed a table-knife in thickness ; breadth nearly five inches, tapering to the tail. Colour silvery, with minute scales ; the dorsal fin of an orange colour, occupying the whole

ridge from the head to the tail, with the rays of unequal sizes. Caudal fin forked, the rays of each fork about four inches long. Pectoral fins very minute: no ventral nor anal fins whatever. Vent immediately under the pectoral fins, and close to the gill-openings. Head about four and a half inches long, compressed like the body, with a groove on the top. Gill-lids formed of transparent porous plates. Eyes one inch and a quarter in diameter. Both jaws armed with small teeth. Lateral line rough, and armed, towards the tail, with minute spines pointing forwards; these being the only spines on the body."

Another specimen found on the beach of Sanda is described as follows:—"Length four and a half feet; breadth eight inches; thickness one inch, thin at the edges of the back and belly. Length of the head five inches, terminating gradually in a short snout. Tail consists of eight or nine fin-bones or rays, the third ray seven inches long, the rest four inches. The dorsal fin reaching from the neck to the tail, rays four inches long. On each side of the fish, from head to tail, a row of prickles pointing forward; distance between each half an inch. Under edge fortified by a thick ridge of blunt prickles. Pectoral fins one inch long, lying upwards. Skin rough. Colour of leaden or silvery lustre; dorsal fin and tail blood-colour. The skin or covering of the head like that of a Herring: several small teeth; gills red, consisting of four layers. Heart half an inch; liver two and a half inches; stomach four and a half inches, full of a gelatinous substance. Flesh perfectly white. Spine in the middle of the fish. Body thin towards the back and belly, and very small towards the tail. Eyes and brain wanting."

Various examples, probably to the number of twelve

or more, appear to have been obtained on the island of Sanda between the years 1817 and 1829. Some of the natives were sufficiently acquainted with it to induce a belief that they had even eaten it. Most of the specimens, varying in size from one to six feet, were driven on shore by bad weather. The Rev. George Gordon, in his list of the fishes of the Moray Frith, published in the Zoologist (3460), mentions two specimens that were obtained in that estuary. Another example is recorded in the Annals of Natural History as having been taken in the Frith of Forth in 1849, and a specimen in the Newcastle Museum was got on the Northumberland coast in June 1844.

Olafsen, in his Voyage to Iceland, states that this fish is rare even in Iceland: it seems to approach the shore at flood-tide, in those places where the bottom is sandy and the shore not steep, and to remain there till left dry. The inhabitants, he adds, consider the fish to be poisonous, because the ravens will not eat it.

The publication of the History of British Fishes has brought me into communication with Professor John Reinhardt, Curator of the Royal Museum, and also of the University Museum at Copenhagen. This gentleman, desirous of supplying the deficiency, both as to representation and description, in the first edition of British Fishes, vol. i. p. 191, has very obligingly forwarded to me a copy of his memoir, printed in the Transactions of the Royal Society of Copenhagen, containing a detailed account and a figure of a Vaagmaer obtained in Iceland. By the kindness of Dr. Cantor, the friend and countryman of M. Reinhardt, I am enabled to present a free translation of so much of this Danish paper as refers to the description of this very rare fish, with a reduced figure from the plate which accompanied the memoir.

The specimen of the Vaagmaer, from which the drawing and descriptions were taken, was during the summer of 1828 thrown up alive on the beach near Thorshavn in Iceland, and was procured by Mr. Möller for the Royal Museum of Natural History. Fortunately, a ship at the time was ready to sail for Copenhagen, by which the fish, preserved in spirits, was forwarded. It arrived in about ten days, and in such beautiful condition that the brilliant red colour of the fins had not faded, nor had the membrane connecting the fin-rays been torn; only the anterior dorsal and the ventral fins were injured, so as to leave but short roots; the continuation of which is therefore indicated by fine lines.

A previous account of this, as well as of another less perfect specimen, which was thrown on shore near Frederickshavn in Jutland, was laid before the Royal Society of Copenhagen in the winter of 1829. As I have not been able to procure a better specimen, says the author, and a useful delineation of this fish is wanted, while we, through the figures given by M. Valenciennes, are enabled to compare several species from the Mediterranean, I have thought it right to supply this deficiency by having an engraving made under my own superintendence of the Icelandic Vaagmaer, to the description of which the following paper is devoted.

The result of the account of the two specimens above mentioned, as communicated in 1829 to the Royal Society of Copenhagen, was, that the Northern Vaagmaer, contrary to the opinion of its former describers, is indeed provided with ventral fins, by which its generic relation to those of the Mediterranean has been decided, as well as its systematic rank; while a comparison with one of the Mediterranean species preserved in the Museum, established its specific difference.

M. Valenciennes, in the excellent account of the genus *Trachypterus* contained in his tenth volume, has added a few remarks to the previous history of the northern species. Although the specimen he examined was dried and partly defective, the relative dimensions and the number of the dorsal rays nevertheless agree. Some difference between the short description of M. Valenciennes and that which follows, will be pointed out hereafter.

The body of the Vaagmaer is compressed like a sword-blade throughout more than half of its own length, or, in the present specimen, from the occiput to within eleven inches of the caudal extremity of the dorsal column; the height is nearly the same at both extremities, and only one-seventh part less than the height at the central part of the body, where it is greatest. In this particular it differs from the two species from the Mediterranean, that have more than one hundred and sixty rays, according to their dimensions given by M. Valenciennes,—namely, those of *Trachypterus falx*, and *Tr. iris*, whose greatest height is at, or near, the occiput, from whence it more or less rapidly decreases towards the caudal fin. Of the *Tr. leiopterus* I am uncertain, as the author has given no dimensions of the height, although he elsewhere states that this species has a caudal fin much thinner than that of the *Vogmarus*.

The colour of the head and body is silvery, varied only by the blackish-grey of the head, and by two obliquely-oval spots of the same colour on each side. The long dorsal fin, and the almost vertical triangular caudal fin, are of a light red. The silvery colour arises from a thin layer on the epidermis, of the same nature as that of the ventral membrane observed in several other fishes. I have not been able to observe any traces of scales. The

skin underneath the silvery pigment is divided or furrowed by diagonal lines, forming small flat elevations, some of which are round, and others angular. Towards the border of the belly, particularly on each side of the sharp edge, these elevations appear as warts of remarkable firmness, but by no means osseous, which, decreasing in size behind the anus, are lost entirely towards the tail.

In the number of its lateral dark spots, the Vaagmaer resembles the *Tr. leiopterus*, which, according to M. Valenciennes, has only two; but in reference to the position of these spots, there exists a difference between the two species. In the Vaagmaer they are placed further backwards, the situation of the most anterior spot being at the commencement of the second fourth part of the whole length of the fish, the posterior being situated about half way, or near the middle. Both spots are nearer each other in the *Tr. leiopterus* than in the present species. The total length of the specimen represented, measured from the point of the nose to the end of the dorsal column, is forty-three inches six lines; with the upper jaw protruded, the whole length is forty-four inches seven lines. The greatest height of the body in the present specimen, twenty inches from the angle of the mouth, or four inches in advance of the anus, is contained five times and a half in the length, while the height at the nuchal region, about six inches from the end of the nose, is contained nearly seven times in the total length. The height at a distance of thirty-six inches is but a little more than one-eleventh of the total length, and at the distance of forty inches it scarcely exceeds one-thirtieth.

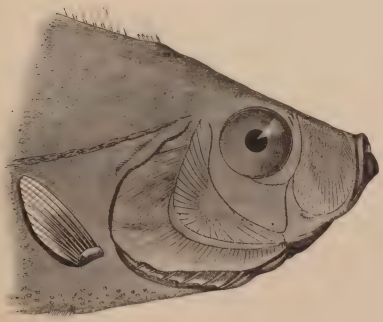
The greatest diameter, which is at the shoulder, near the lateral line, is contained four times in the height of

that region, or five times in the greatest height, the diameter of which is scarcely one-tenth. The fish becomes thinner towards the narrow part of the tail, and also towards the dorsal and ventral profile, particularly towards the former, where it is sharp like the edge of a knife, and the interspinous bones show through the thin external covering.

The head forms less than a seventh of the total length, and its length is therefore nearly equal to the height of the fish at the nuchal region. The outline of the mandible is an ascending arc, which meets the straight and slightly-declining profile of the forehead, when the mouth is shut. When the mandible sinks into a horizontal position, the upper jaw is greatly protruded, and becomes somewhat longer than the lower one.

The formation of the jaws, the form and position of the gill-covers, and the radiating grooves on the latter, on

VAAGMAER WITH THE MOUTH CLOSED.



the jaws and frontal bones, agree with the description of those parts in the *Tr. falx*, as given by M. Valenciennes.

The dentition in this species appears to exhibit some deviations from that of *Tr. iris* and *Tr. Spinola*, in which the teeth of the upper and lower jaw are nearly vertical, and are visible even when the mouth is more than half closed. In the description of *Tr. falx* no mention is made of the position of the teeth. In the Vaagmaer the maxillary teeth are thin, conical, and pointed, nearly recumbent, with the apex turned towards the pharynx. On the premaxillary bones only four teeth appear, two on each bone, somewhat within the margin: the inner teeth do not exceed two lines in length. On the mandible the teeth are placed nearer the outer margin, and towards the front, four on one side, three on the other, with some variation in size. A single-pointed tooth, three lines in length, depends vertically from the central line of the vomer, but no other sharp teeth appear either behind this tooth, or on the palatine bones, which, according to M. Valenciennes, is the case in *Tr. falx*. The superior pharyngeal bones are studded with pointed curved teeth, one line in length; the inferior pharyngeal bones are wanting altogether.

The large eyes, lodged in a circular orbit, are situated near the frontal profile. The longitudinal diameter of the orbit is, compared to the length of the head, as one to three and a half; the iris is silvery-white, with a breadth somewhat greater than the diameter of the pupil. The nostrils are very small, opening into narrow cavities, situated above the anterior and superior part of the orbital margin; the larger nostril is a small slit situated close upon the margin; the smaller one is oval, and is placed a little higher up. The anterior extremity of the tongue is somewhat broad, with a rounded margin, con-

cave above, flat and keeled underneath; the tongue is entirely free, and may easily be placed in a horizontal position, as if intended to throw small bodies towards the pharynx.

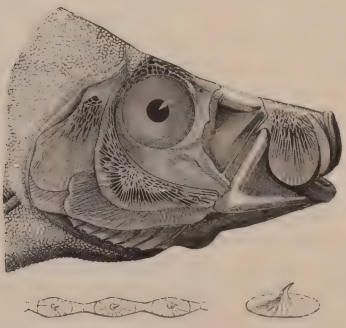
The lateral line, commencing from the nuchal region, descends nearly vertically opposite the middle of the orbit, from whence it proceeds obliquely downwards, until it reaches a position behind the pectoral fin, somewhat nearer the ventral profile than the dorsal one: from thence it continues straight towards the extremity of the tail. This line is covered by a series of small oblong osseous shields, each with a small central spine directed forwards. (See p. 292.) The shields and their spines increase in size towards the thin part of the tail, from whence they again decrease, although the last shield is much larger than those of the central part.

The short pectoral fins are situated nearer to the ventral profile than to the lateral line, and are nearly opposite the apex of the gill-cover. The number of the rays is in the right pectoral fin eleven, in the left one only ten. Of the ventral fins, there remain merely some short roots of rays, situated close to the ventral margin, in a direction nearly parallel with, but a little further back than, the pectoral fins. The number of the rays is six.

Of the rays of the anterior dorsal fin only five roots are left, the first of which is somewhat thicker than the rest, and is situated five inches eight lines from the edge of the closed jaws. The interval between this fin and the commencement of the posterior dorsal fin, is twice the distance between two rays. The posterior, or long dorsal fin, has one hundred and seventy-two rays, of which the first ray is situated six inches and one line from the point of the jaw; and the last ray half an inch from the last vertebra. The anterior part is very low, increasing in

height by degrees until it reaches the commencement of the last fourth part of the total length, where the height of the present specimen amounts to three inches eleven lines, or about one half of the greatest height of the body; from thence it decreases rapidly, so that the last ray is only a little longer than the first. The rays are slender, flexible spines, without the slightest trace of transverse joints; their articulating surface dilates into a saddle-shaped shield, with a short curved point in the centre, by which a number of small sharp bodies appear along the root of the fin. The rays themselves, however, are quite smooth to the touch, and, under a lens, are, as M. Valenciennes found them, a little sharp. The elevated caudal fin contains eight rays, of which the central ones are sharp to the touch, being studded with a number of small spines.

VAAGMAER WITH ITS MOUTH PROTRUDED.



SCALES OF THE LATERAL LINE.

BANKS'S OAR-FISH.

Regalecus Banksii, Gray, Pr. Zool. Soc. for 1849, p. 80.
Gymnetrus Banksii, Cuv. et Valenc. Poiss. x. p. 365.

Regalecus. *Generic Characters.*—Greatly compressed and elongated sword-shaped fishes. Teeth minute or none. Dorsal fin rising on the occiput like a plume. Caudal said to be continuous with the dorsal, and to embrace the point of the tail, but seldom seen entire, and of doubtful form in most species. Ventrals uni-radiate and very long, edged with membrane which expands at the end. Branchiostegals seven. A very long slender tapering stomach, of which three-fourths is cæcal; pancreatic cæca simple and very numerous. Scales microscopical in the nacry epidermis, also scattered osseous tubercles in the skin. No air-bladder.

In the Banksian library at the end of a quarto copy of Pennant's British Zoology, published in 1776, is the following manuscript note:—"On Saturday, the 23rd day of February 1788, was caught near Newlyn Quay, on the sand at ebb-tide, a fish which measured in length eight feet four inches, in breadth ten inches, and thickness two inches and a half; its weight was forty pounds." Another marginal note states further that "a gentleman

who saw this fish informed Capt. Chemming (Chelwyn? or Chirgwin?) that the tail was not perfect." A figure which accompanied these notices has been reproduced in part, and of reduced size, by Dr. Gray, in a paper published in the Proceedings of the Zoological Society, for May 29, 1849. In this the front ray of the dorsal fin standing on the forehead between the eyes is very long and tapering, and curves forward before the face: the following ten rays diminish successively in length, and are not represented as being connected by membrane: the rest of the dorsal is comparatively low, and has only the tips of the rays rising above the continuous membrane. The ventrals have each one long ray dilated into a broadly-oval pallette, apparently of membrane, folded or radiated.

Pasted into the same copy of Pennant there is also a paragraph cut from the York Chronicle, stating that on the 18th of March 1796 four women picked up a curious and uncommon fish, which came ashore in Filey Bay. They sold it to a man who carried it to York. Sir Joseph Banks's correspondent sent him a tracing of a drawing of the fish by Dr. Burgh, together with observations which are here abridged from Dr. Gray's paper:—"Thirteen feet long, one foot deep, three inches thick, head seven inches long, eye one inch three-eighths in diameter. The dorsal fin runs from the head to the other end, at which there is no tail; it has 290 and 13 rays, and is red like that of a roach or perch; the pectoral has twelve; the ventral one; no anal. Branchiostegous rays six. No teeth, a soft tongue. Anus, four feet nine inches from the head. The face, and inside of the mouth, black; the irides silvery white. Though there was no caudal fin when I saw it, it is not clear that he never had one, for there was an appearance of mutilation in its place.—W. B."

Notices of the capture on our coasts of similar fish,

but mostly too imperfect for the identification of species, occur in various periodicals. The Annual Register records the taking of one of these at Whitby on the 22nd of January 1759; and Mr. Stanton of Newcastle informed Messrs. Hancock and Embleton, that about the end of the 18th century he recollected the exhibition of a similar fish in Newcastle. It was ten feet long, and two inches thick. A sketch was made of it by Bewick the celebrated wood-engraver, which has been unfortunately mislaid. The same gentlemen were told by John Blackett Anderson, of Walker, near Newcastle, that he recollects the capture of two fishes about the year 1800, in a shallow pool at the outer Fern Islands. The larger was eighteen feet long, about a foot deep, and of a silvery colour. In 1796 one was got at Cullercoats, near Newcastle, as mentioned in a pamphlet published by John Such, of that town, in 1849. On the 19th of March 1844, one was stranded, after a severe north-east gale, at the village of Crovie, in the estuary of the Doveran, near Macduff in Banffshire, and was afterwards exhibited in the Town-hall of Elgin. From the correspondence of Mr. John Martin of the "Elgin Institution," with the late Dr. Johnston of Berwick, and the sketches he sent, I (Mr. Yarrell) entertain no doubt of its specific identity with the *Regalecus* to be fully described below, and whose portrait is placed at the commencement of this article. Mr. Martin states the measurements of the Crovie specimen to be, total length twelve feet; depth one foot; thickness two inches and three-quarters; height of the dorsal fin two inches and a half, length of the ventral rays three feet; length of the pectorals two inches and a half. The head measured nine inches from the symphysis of the mandible to the end of the gill-cover; and from thence to the vent the distance was forty-six inches. There was no caudal fin. The

shaft of each ventral was about the thickness of a goose-quill, was fringed on each side by membrane, and broken short off at the extremity; the ends having been thrown away at the sea-side, their original length could not be ascertained. The dorsal fin contained two hundred and seventy-nine rays, of which fifteen standing on the head were very tall, but were connected at the base by membrane. The pectorals were supported by twelve rays. The lateral line was straight, and about one-third of the height above the ventral profile, except where it rose gradually over the pectorals. The body is described, and the drawings represent it, as having a slightly-tapering profile from the operculum to the end, which is rather abrupt, with a spur at its lower corner, and without any indication of a caudal fin. If one existed, Mr. Martin thinks that it must have been very slender. The whole body was clothed by a delicate white skin with a silvery lustre, beneath which there lay alternate smooth and tuberculated bands running the whole length of the body, palpable to the finger through the outer skin, and becoming more perceptible on its removal. Behind the pectoral fin, a few dark bars, which crossed the body obliquely, were very conspicuous when the fish was fresh, and the dorsal had at first an orange tint.

In Messrs. Hancock and Embleton's paper it is mentioned that one of the Preventive Service men, in the year 1845, observed a fish of this kind in a pool near Alnmouth. On his approach it bent its body into a circle, and he, ignorantly thinking that it was going to spring upon him, boldly attacked it with his cutlass and cut off its head. It was sixteen feet long, eleven inches deep, and six thick. In the struggles of the dying fish, the sands around were covered with its delicate nacry scales.

On the 26th of March 1849, a fine fish of this genus was captured by the crew of a fishing coble belonging to Cullercoats, consisting of Bartholomew Taylor and his two sons. It was much injured by the captors in their endeavours to secure it, and by subsequent handling during its exhibition at Tynemouth, North and South Shields, and Newcastle. Fortunately it was seen at the last-named town by Albany Hancock, Esq., and Dr. Dennis Embleton, who made drawings of it, and drew up a detailed account of its external appearance and internal structure, which was read at a meeting of the Tyneside Naturalists' Club, and published in the Annals and Magazine of Natural History for July 1849. From that paper the following abridged extracts were taken.

The fish, though much injured and greatly faded, was fresh and had a uniform silvery-grey colour, except a few irregular streaks and dark spots towards the fore-part of the body, and there were remains of a bright iridescence about the pectoral fin and head, a blue tint predominating. The body is excessively compressed, like a double-edged sword-blade, its greatest thickness being below the middle, and the dorsal edge is sharper than the ventral one. The total length when the mouth is retracted is twelve feet three inches, and the depth immediately behind the gills eight inches and a half: two feet farther back the greatest depth of eleven inches and a quarter is attained, and at the end of the dorsal fin it has diminished to three. The skin is covered with a silvery matter in which the scales are invisible to the naked eye, but which is easily detached and adheres to anything it comes in contact with. Submitted to the microscope, this nacre was found to consist of scales like those on the wing of a moth. Round the hind border of the operculum there is a broad dusky patch; a crescentic dark mark exists

above the eye, and there are eight or nine narrow oblique streaks on the side, which diminish to mere spots beyond the vent. The lateral line descends gradually from the suprascapula to within two inches of the ventral profile at the vent, and continues descending as it proceeds to the distal end of the fish. Four flattened ridges, each more than an inch in breadth, reach from the head to the tail above the lateral line, the longest and uppermost commencing near the eye. The skin is studded with numerous bony tubercles not regularly arranged, and in the neighbourhood of the head they are replaced by depressed indurations. On the ventral edge the tubercles are numerous and have hooked tips pointing towards the tail.

The head is small, measuring only nine inches to the gill-opening; the orifice of the mouth is circular and capable of being protruded two or three inches by the depression of the mandible. The tongue is small, smooth, and prominent; there are no teeth, and the interior of the mouth is black. Gill-plates proportionally large, preoperculum crescentic, with the lower horn prolonged forwards to the articulation of the mandible. Operculum curved elliptically posteriorly, ending obtusely. Branchiostegals seven. Branchial arches four, with tubercular bristly rakers. Pharyngeal bones above and below furnished with setaceous teeth.

The dorsal fin extends from between the front of the orbits to within three inches of the distal extremity of the fish. The twelve anterior rays were stated by the captors to have been about fourteen inches long, and furnished with a membrane on their posterior edges, which grew wider upwards, somewhat like a peacock's feather. The ends were broken off, but a continuous membrane connected their bases, and their shafts appeared ragged

with the remains of the torn membrane. In addition to these there were 268 other rays whose acute points overtopped the connecting membrane, or 280 dorsal rays in all. About the middle of the fish, where, excepting those on the head, the dorsal rays are highest, they measure upwards of three inches and a half, and at the termination of the fin their height has decreased to one inch. Behind the termination of the dorsal fin the edge of the back slopes rapidly downwards to within an inch of the line of the belly, and then forms a rounded point which is the distal extremity of the fish. Both the upper and under edges of this extremity are very thin, and the fishermen insisted that when they took the fish this part was entire, and that there was no tail-fin whatever. The edges may be pressed together, and seem to fit. The pectorals are attached low, and contain eleven rays. The ventral fins were represented by a pair of very strong straight spines broken short to the length of four inches, but were said to have been originally twice that length, having even then broken ends; a membranous edge was visible at their bases. The vertebræ, judging from elevations obscurely seen through the muscles, were reckoned at 110. Fin ray formula—

D. 280: V. 1: P. 11. Vertebræ 110?—*Hancock and Embleton, l.c.*

Messrs. Hancock and Embleton's excellent paper may be consulted for the internal anatomical structure, and several particulars of external form, which have been omitted here from want of space.*

In 1850, another example of this fish, alive but mutilated, was cast ashore on the Yorkshire coast, near Redcar. It measured nearly twelve feet, and weighed sixty-six pounds, as reported in the *Zoologist* (2709) by T. S.

* For a larger cut of the head copied from this paper, see foot of page 304.

Rudd, Esq. In the same communication, mention is made of one found on that coast several years previously by a pilot named Slater Potts: its length was twenty-four feet, which, if correct, it is the largest example of this species that has been recorded. Another was stranded on the 17th of September 1852, near Millar's Stone, in the Bay of Cromarty. This specimen was secured for the museum of Mr. Dunbar at Inverness, and on the dispersion of that collection some years ago, came into the hands of a bird-stuffer of the same place, who kept it hanging in his shop until he tired of looking at it, and no purchaser offering, it was at length consigned by him to the dust-cart.

A northern member of this genus was described by Ascanius under the name of *Ophidium Glesne* in the Copenhagen Memoirs for 1776, the generic name being afterwards changed to *Regalecus*, by which he intended to signify King of the Herrings. Glesne is the name of a village near Bergen, where the fish was taken. This species, which received other names from ichthyologists who came after Ascanius, has been supposed to be the same with the British fish; and the case may be so, but hitherto the Norwegian fish has been described by Ascanius and Brünnich alone, and the one reckons only 126 rays in the dorsal fin, and the other 197, while the figures given by these authors show a greater number. This reckoning, however, is so different from the numbers of the rays in the British fish, that they cannot be considered as the same species until the mistake, if there be one, has been rectified by an accurate examination and comparison of specimens. *Gymnetrus Grillii* of Lindroth, described in 1798, had the large number of 406 dorsal rays, with a total length of eighteen feet, and ventrals measuring five. It is therefore safer for

the present to keep Messrs. Hancock and Embleton's fish distinct under the name of *Banksii*, proposed by M. Valenciennes in the *Histoire des Poissons*. The right of priority over the term *Gymnetrus* belongs to *Regalecus*, and this is therefore used here, though M. Valenciennes rejects it for its barbarity. The name of *Gymnetrus* is reserved, however, for the probably apocryphal species which will form the subject of the next article.

Ascanius saw two examples of his *Regalecus Glesne*, one of them measuring eleven feet and a half, and the other a foot less. Both these, and also a specimen seen by Lindroth which measured twelve feet, had a caudal fin continuous with the dorsal, and embracing the point of the tail. The annexed cut is copied from Schneider's edition of Bloch, and is derived from the original figure of Ascanius, with an alteration in its attitude. Brünnich also figured this fish under the appellation of *Regalecus remipes* (*Kongel. Danske Bidensk. Selsk. Skrift. Kiobenh.* 1788. p. 220. tab. B. *f.* 4, 5), and has been copied by Waulbaum. Lindroth, however, says that both the original figures were done from the dried and shrunk specimens, after the external form had undergone some change. The pectorals reach the vent in Brünnich's figure.

REGALECUS GLESNE. FROM SCHNEIDER.

HAWKINS'S GYMNETRUS.

CEIL CONIN, *Cornwall.*

Gymnetrus Hawkinsii, Bloch, Schn. p. 481.
,, *Hawkenii*, Bloch, part 12, p. 88, pl. 425.
,, ,, Shaw, Gen. Zool. iv. p. 197.
,, ,, *Ceil Conin*, Couch, Tr. Lin. Soc. xiv. p. 77.

Bloch established the genus *Gymnetrus* on a drawing sent to him by an Englishman named Hawkins, of an Indian fish caught at Goa, in July 1783. The drawing was avowedly incorrect, for the tail of the fish having been broken off, the artist had supplied the loss according to his fancy by a forked caudal. Perhaps the representation of two rays in each ventral is also an error of the artist's, and if so, *Gymnetrus*, as founded by Bloch, must be rejected; because the chief known character in which that genus differs from *Regalecus* of Ascanius is, as mentioned in the preceding article, in the structure of the ventrals. The rarity of these Riband fishes, the tenderness of their framework, and the brittleness especially of their fin-rays, are such that they are often mutilated during life, and no perfect specimen of a full-grown individual has fallen under the observation of a naturalist competent to describe it.

In February 1791, a fish was taken at Newlyn Quay on the western side of Mount's Bay, in Cornwall, which was considered to be an example of Bloch's *Gymnetrus Hawkenii* or *Hawkinsii*,* and a drawing made of it, which, together with some descriptive notes, is now in the possession of William Rashleigh, Esq., of Menabilly, in the county of Cornwall. From these documents, Mr. Couch's account of the fish is derived, and the woodcut at the head of this article is a copy of the drawing. Mr. Couch's words are:—

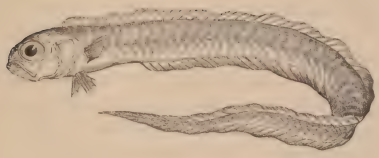
"The length, without the extremity of the tail, which was wanting, was eight and a half feet; the depth ten and a half inches; thickness two and three-quarter inches; weight forty pounds. In the drawing, the head ends in a short and elevated snout; eye large; pectoral fin round; no anal fin; the dorsal fin reaches from above the eye to the tail. In the drawing, as well as in Bloch's engraving, the caudal fin is supplied. The ventrals are formed of four long red processes, proceeding from the thorax, and ending in a fan-shaped appendage, of which the base is purple, the expansion crimson. The back and belly are dusky green, the sides whitish: the whole varied with clouds and spots of a darker green; the fins crimson."—*Couch.*

The same doubt clings to the drawing of the Cornish fish that is entertained respecting the figure of the Indian one. It is evident that Bloch's work was referred to when the fish was found, and M. Valenciennes is even of opinion that the one figure is a copy of the other. As no further light is likely to be thrown on the Mount's Bay specimen, the species must be considered as apocry-

* Bloch, mistaking his correspondent's name, called him "Hawken" in his great work, but this was correctly stated to be "Hawkins" in his posthumous *Systema*, edited by Schneider.

phal, or at least doubtful, unless a similar fish with bi-radiate ventrals should be thrown on our shores, and furnish materials for correct delineation and description. It may be observed, however, that bi-radiate ventrals in members of this family are not wholly imaginary, as the *Gymnetrus Russelii* (Valenc.) of the Indian Ocean has one long ray and one short one in each ventral; and should there actually be two species in our seas, it is quite possible that both may have been captured at the same place and at the same season of the year.

Banks's Oar-fish (Hancock and Embleton).



THE RED BANDFISH, OR RED SNAKEFISH.

Cepola rubescens, Linn. Cuv. et Valenc. Poiss. t. x. p. 388.
,, ,, Montagu, Linn. Trans. vol. vii. p. 291, tab. 17.
,, ,, *Red Bandfish*, Penn. Brit. Zool. vol. iii. p. 285.
,, ,, ,, ,, Donov. Brit. Fish. pl. 105.
,, ,, ,, *Snakefish*, Couch, Linn. Trans. vol. xiv. p. 76.

Cepolædæ. *Family Characters.*—Taenioid or stiletto-shaped fishes, with a pointed caudal, small scales and a medium-sized mouth, not protractile. Teeth slender, acute. Eyes large or middle-sized. Branchiostegals six. An anal and ventrals. Stomach retort-shaped; pancreatic cæca neither numerous nor complicated, and unlike those of the Scomberoids. (*Cepolidarum pars*, Bonap.)

Cepola. *Generic Characters.*—Aspect of some Gobioids or of *Ophidium*, the head in particular much like that of *Amblyopsis*, but with a large eye. Vertical fins united in the pointed caudal, the straight-edged dorsal running forwards to the head: anal only a little shorter, the vent being far forward. Cleft of the mouth forming an angle of about forty-five with the axis of the fish, the mandible being the most anterior part when the orifice is closed. Only two or three of the dorsal rays are jointless, and only one in the anal, and these are flexible, the only stiff bony spine being the one in each ventral. Stomach like a bag-pipe placed vertically; pyloric cæca eight, conical. Air-bladder very large. Vertebræ sixty-nine.

Colonel Montagu first described the Red Bandfish as a British species in 1803. Two specimens were taken in Salcombe Bay, on the south coast of Devonshire,—the first in February, the second in March; and a description and figure of it appeared in the Transactions of the Lin-

nean Society, vol. vii. In 1822, Mr. Couch described this species in the fourteenth volume of the Transactions of the same Society; and on referring to his MS. I find the following additional information:—"Until within a few years the Red Snakefish had not been recognised as a British species; yet it is not uncommon on the western coast. No less than nine specimens have fallen into my hands, of which three were at different times killed and thrown on shore by tempests. One rather large was taken from the stomach of a Hake; and one more, at least, was taken with a line."

Since then one of fifteen inches in length was caught off Dunure, seven miles south of Ayr, on a whiting line baited with a mussel; and after a violent storm which occurred about the 14th of February 1839, great numbers of this previously-scarce fish were thrown ashore along a considerable portion of the Devonshire coast. The Rev. Robert Holdsworth sent me word that they were abundant at Brixham; and Mr. Harvey, who was then residing at Teignmouth, obtained more than a score, and sent several prepared specimens to the Museum of the Zoological Society, and others to his London friends. Some of these examples measured from eighteen to twenty inches in length.

The form of the body is long, slender, smooth, and compressed; this latter character increasing with age and size, small specimens being oval, or almost round: the body tapers gradually, both as to thickness and depth, from the head to the tail; the lower jaw is the longest when the mouth is opened; the mouth is large, and its angle depressed; the tongue short and smooth: both jaws are furnished on their outer edges with a row of conical, curved, pointed teeth, not set close together, and inclining outwards; in the anterior part of the mandible,

there are a few teeth, forming a second row: the eyes are large; the nose short; the pectoral fins are small and rounded, and the ventrals are placed rather before them; the first ventral ray is spinous, and the innermost one is joined to the side by membrane; the dorsal fin commences immediately over the centre of the operculum, and extends to the tail fin, the anterior rays being shorter than the others; the vent is about an inch behind the ventral fins, and the anal fin commences immediately behind the vent, extending like the dorsal fin to the end of the tail, and having also the anterior rays rather shorter than the others; the caudal fin is lanceolate, the middle ray being the longest: the distinction between the rays of the dorsal, anal, and caudal fins is almost lost by membranous union. The lateral line, which is not very obvious on some parts of the body, is a little curved near the head, and afterwards runs quite straight to the tail fin; the skin is smooth, but when examined with a lens, appears finely and regularly punctured. A specimen seven and a half inches long, for which I am indebted to the kindness of Mr. Couch, exhibits here and there an occasional thin, oval, semi-transparent scale.

The irides are silvery with a tinge of crimson, pupils bluish-black; gill-plates silvery. The body appears subject to some variation in colour. One of Colonel Montagu's specimens was pale carmine, the second darker. Mr. Couch had specimens of a pale red, and one, in which the margin of the dorsal fin was purple, the base yellow, and the middle red. A dried example from the Mediterranean, now before me, is orange-red; the Cornish specimen, preserved in spirits, has lost colour, and has become greyish-orange. Brünnich, describing the colour of his *Cepola rubescens*, calls it *pallide carneum*, pale flesh-colour: and M. Risso says it is the colour of the red oxide of

mercury. Brünnich, in a note at the end of his description of *Cæpola rubescens*, asks, Is this fish distinct from the *tænia* of Linnæus, and how? The latter is said to be distinguished by a row of hard points along the side, above the lateral line, and by an inner second row of teeth on the lower jaw. My Mediterranean specimen, thirteen inches long, has the rough line just below the base of the dorsal fin, and a second row of six small teeth within the lower jaw.

With reference to the first of these characters, it is essential to remark, that Mr. Couch, in his description in the Linnean Transactions of a Cornish specimen fifteen inches long, says, "Besides the lateral line, there was a row of small bony prominences near the dorsal fin."

The numbers of fin rays in a small specimen are—

D. 69: P. 16: V. 1+5: A. 61: C. 11.

Of the habits of this fish but little is known. M. Risso says, that when moving in the water its appearance has suggested the epithets of Fire-flame and Red-riband, by both of which names it is known at Nice. He adds, also, that it lives principally among seaweed near the shore; and though it feeds on crustaceans and mollusks, yet its flesh is not esteemed for its flavour.

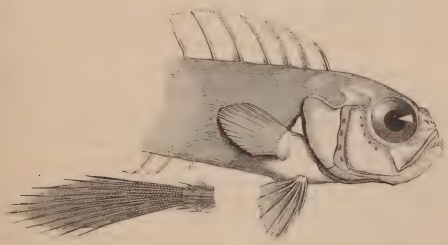
"The air-bladder of this fish," says Mr. Couch, "is remarkable for its large size, and for the chief part lying, not in the abdomen, but behind it, occupying the space from the spine behind the vent and along the anal fin."

It may be worth noticing here, that a large proportion of the riband-shaped fishes that have been obtained in this, as well as in other countries, have been found on the shore after stormy weather.

Does their form prevent their swimming with ease in mid-water, cause them to keep near the ground, and to

seek cavities among rocks for shelter, thus rendering them liable to be left dry by the retiring tide? The combination of great length with extreme tenuity of body, by diminishing the quantity of muscle, and at the same time preventing its being brought into concentrated action upon a single centre of motion, must necessarily leave them at all times much at the mercy of the currents, amid which they may wriggle or float, but against which they are evidently incapable of swimming with continuous and vigorous effort: by their struggles in the ocean, they cannot fail to become speedily exhausted, and they are then ejected by the waves upon any coast toward which the winds may have driven them.

The vignette below represents the head and caudal fin of this fish of enlarged size.



THE GEMMEOUS DRAGONET.

ROTCHET, ELLECK, YELLOW SKULPIN, GOWDIE, CHANTICLEER, *Scotland.*—MORDDRAIG, *Wales.*

Callionymus lyra, LINNÆUS. CUV. et VALENC. xii. p. 266.
,, ,, *Gemmeous Dragonet*, PENN. Brit. Zool. iii. p. 221, pl. 31.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 9.

CALLIONYMIDÆ. *Family Characters.*—Fishes with a very protractile mouth, a large depressed head, and large ventrals widely separated; also spinous dorsal rays tapering and flexible. Branchiostegals six or seven. Bones of the gill-cover often spiniferous. Skin scaleless or scaly. No air-bladder. Caudal fin large, often elongated and pointed. (Comprising *Callionymus*, *Harpagifer*, *Trichonotus*, *Platypterus*, *Comephorus*, and *Chænichthys*.)

CALLIONYMUS. *Generic Characters.*—Gill-openings reduced to a small hole on each side of the nape. Eyes approximating. Villiform teeth on the jaws, none on the palate. Preoperculum emitting a bony process, terminated by diverging spinous points. First dorsal elevated, its rays flexible and setaceous; second dorsal and anal long. Skin generally smooth. Branchiostegals six. Males and females dissimilar.

THE GEMMEOUS DRAGONET, so called from its brilliant gem-like colours, was first described as a British fish by Dr. Tyson. in the twenty-fourth volume of the Philosophical Transactions. The second term, that of Dra-

gonet, was deduced by Pennant from the trivial name, attached to the second British species, *dracunculus;* that name, in its turn, having probably been given with a double reference to its speckled appearance, and also to its large wing-like ventral and pectoral fins; which induced Belon, Seba, and others, to consider it as allied to the flying fishes.

In Banffshire it is named the Bridegroom, evidently from its gay colours. The prevailing colour is a golden yellow, whence it is called Yellow Skulpin in Cornwall, —and the northern term Gowdie or Goldie means yellow or golden. The Gemmeous Dragonet is a handsome fish, with a smooth skin, and a head singularly spotted and striped with blue on a yellowish ground. When fresh from the water, these colours are vivid, and the appearance of the fish attractive. Linnæus indulged his fancy by attaching the term *Callionymus*, which signifies literally, beautiful name, to a prettily-marked species; and the word *lyra* was doubtless suggested by the resemblance of its elongated dorsal filament and fin-rays to the strings of a musical instrument.

The Gemmeous Dragonet is not a common fish on our coast, and, according to my own observation, is much more rare than the Sordid Dragonet. It has been taken on the coasts of Cumberland and Down. Mr. Couch has met with it occasionally in Cornwall, where it frequents deep water, generally keeping close to the bottom. Colonel Montagu considered it rare, and only obtained one specimen, about nine inches long, which was taken off the bar at Salcombe in Devonshire, in the autumn of 1809; Mr. Barron has occasionally procured a specimen on the Hampshire coast, and it has also been obtained at Weymouth and Hastings. On the eastern coast, it has been noticed at Harwich, Yarmouth, Scar-

borough, and Berwick. Mr. Neill and Dr. Parnell record it among the fishes of the Forth; it is not uncommon in the Moray Frith according to the observations of the Rev. Messrs. Harris and Gordon; and Mr. Low includes it in his *Fauna Orcadensis*. It is enumerated by Nilsson among the fishes of Norway, and is mentioned by most of the Northern ichthyologists. Brünnich, Risso, and the Prince of Musignano, also record this species as belonging to the Mediterranean.

The Gemmeous Dragonet occasionally takes a bait, but is more frequently caught in a net, and sometimes, when of small size, by the shrimpers in sandy bays. Young specimens only six inches in length possess the elongated dorsal filament. Its food consists of testaceous animals, which are swallowed whole, soft mollusks, and worms. The flesh is said to be white, firm, and of good flavour. It is very frequently the prey of other fishes.

The length of the specimen described is ten inches, and the length of the head, as compared to the whole length of the fish, one to four: the form of the head is oblong-ovate, measuring two and a half inches in length, and but one inch and a half in breadth; the anterior half of the head is before the eyes, the orbits occupy one-third, and the space behind is equal to the breadth of the orbits. The branchial apertures are small orifices above the opercula, one on each side of the nape of the neck. The head is flat both on the dorsal and ventral aspect; and the profile of the nose convex; the inferior angle of the preoperculum ends in three spines, directed upwards, and the posterior edge of the gill-cover is connected to the shoulder by a continuation of the common covering of the body.

The mouth is deeply divided, measuring seven-eighths of an inch from the angle of the gape to the point of

the upper jaw; the teeth occupy a broad surface in front, which becomes narrower as the band proceeds backwards: on the point of the mandible there is a single row of longer and more curved teeth, anterior to the others; and the inside of the mouth is furnished with two transverse folds of lining membrane subservient to the protrusion of the premaxillaries.

The anterior dorsal fin, of four rays, commences in a line with the origin of the pectorals: its first ray is very much elongated, and reaches to the base of the tail; the second ray is two-thirds of the length of the first one; the third ray half the length of the second; and the fourth one is short, being only about one inch in length. The numbers of the fin-rays are—

D. 4. 9: P. 20: V. 5: A. 9: C. 10.

The posterior dorsal fin has eight rays of equal length, and is about as long as the body of the fish is deep; the ninth ray is divided, and is nearly as long again as any of the preceding rays of that fin; the last dorsal fin-ray is in a line with the last ray but two of the anal fin. The ventral fins are large, with all the rays branched, and connected by a dense and strong membrane; the last ray is attached by a membrane to the body of the fish, and to the base of the pectoral fin. The pectoral fin, triangular in shape, has the central rays longest; all its rays are slender and branched, and the connecting membrane is delicate and transparent. The vent and post-anal tubercle are directly under the second ray of the second dorsal fin; the elongated tubercle is perforated, and admits a fine probe which passes to the urinary organs. The anal fin commences under the third ray of the second dorsal; its last ray is as long again as the preceding one, and reaches to the end of the fleshy por-

tion of the tail. The caudal rays are elongated, articulated, and branched.

The body of the fish is much narrower than the head, and is rounded, but tapers gradually to the tail. The lateral line is a well-marked elevated ridge.

The prevailing colour of the body is yellow, of various shades in different parts, and is striped and spotted on the head and sides with sapphirine-blue; the irides are orange, and pupils blue. The membranes of the dorsal fins are pale brown, varied with darker longitudinal bands; the ventral, anal, and caudal fins, are bluish-black, and the under surface of the head and body are white, with a dark patch between the limbs of the mandible.

The Prince of Musignano, in his *Fauna Italica*, has figured the female of the same colour as the male, but without the elongation of the fin-rays.

FEMALE GEMMEOUS DRAGONET.

THE SORDID DRAGONET.

FOX, *Kentish coast.*—SKULPIN, *Cornwall.*

Callionymus dracunculus, LINNÆUS. CUV. et VALENC. xli. p. 274.
,, ,, *Sordid Dragonet*, PENN. B. Zool. iii. p. 224, pl. 32.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 84.

THE SORDID DRAGONET, so called from its comparatively dingy hue, is the most common species of the two, but generally occurs of small size. It is frequently taken at the mouth of the Thames, where, on account of its reddish appearance, it is called the Fox.

The general accordance in the situation of the fins and the number of their rays in the two British Dragonets, has raised a suspicion, first entertained by Gmelin, that they are but males and females of the same species. Mr. Neill, in the Wernerian Memoirs, vol. i. p. 529, supports this opinion; having found that the specimens of *C. lyra* examined by him were all males, while those considered as *C. dracunculus* were all females. Dr. George Johnston, of Berwick, has, on the other hand, recorded in the third volume of the Zoological Journal, that he had found a Sordid Dragonet, with a milt, or soft roe; and the Rev. George Harris states that he not only found a milt in a Sordid Dragonet, but also a roe in a Gemmeous

Dragonet (Zoologist, 2999 and 3118). The external differences between the two fishes are so obvious, that I have considered them to be distinct species: and Mr. Couch has observed certain differences in their habits:—"The Yellow Skulpin prefers deeper water; whereas the other will often approach the margin of the tide, where it keeps at the bottom, among sand or stones, and never rises but to pass from one station to another, which is done with great suddenness and rapidity. It possesses great quickness of sight, and darts with swiftness when alarmed, though not to a great distance; and I have seen the Sordid Skulpin repeatedly mount after its prey, and invariably return to the same spot again. This motion is chiefly performed by the ventral fins; and the eye is well adapted to these habits, the muscles of that organ being fitted to direct the sight upward, but not downward. It sometimes takes the hook, though rarely; and it is often found in the stomachs of the larger fish. It feeds on shell-fish, worms, and molluscous animals."—*Jon. Couch.*

The length of the specimen described was nine inches; the length of the triangular head being to the whole length as one to five; both head and body are much more depressed than those of *C. lyra;* the eyes are removed only one diameter of the orbit from the nose; and the mouth measured but half an inch from the angle of the gape to the point of the upper jaw: the preoperculum is armed with three spines; the fins are similar to those of *C. lyra* in situation and in number of rays, but the rays of the first dorsal are shorter than those of the second one, which latter are of uniform length.

D. 4. 9: P. 20· V. 5· A. 9: C. 10.

The prevailing colour is a reddish-brown, with a few dark spots on the sides in young fish; the dorsal fins are

pale brown without stripes; and all the under surface is uniformly white, the anal fin being even whiter than the belly. The intestines in the Dragonets are very transparent. There is no swimming-bladder.

The colours of the body and fins decidedly differ in the two species: in *C. lyra*, the head is to the whole length as one to four; the eyes are removed two diameters from the end of the nose; the head is elongated and elevated; the distance from the point of the nose to the posterior edge of the orbit, and thence to the origin of the first dorsal fin-ray, equal; the mouth large; and the lateral line prominent. In *C. dracunculus*, the head is to the whole fish as one to five; the eyes are but one diameter above the snout; the head is depressed, strictly triangular; the distance from the eye to the first dorsal fin-ray is double that of the distance from the point of the nose to the eye; the lateral line is much less distinct, and the mouth only half as deeply divided. This species has been taken all round the Irish coasts, and is equally common in Scotland.

SORDID DRAGONET.

THE BLACK GOBY.

CRAIGBYSG DU (OR BLACK ROCK FISH), *Wales.*

Gobius niger, Linn. Cuv. et Valenc. Poiss. t. xii. p. 9.
,, ,, *Black Goby*, Penn. Brit. Zool. vol. iii. p. 288, pl. 42.
,, ,, ,, ,, Jenyns, Brit. Vert. p. 385.
,, *Britannicus*, Thomps. Nat. H. of Irel. iii. p. 111.

Gobiidæ. *Family Characters.*—Two dorsals, the spinous one with slender and flexible rays, more rarely the two parts are united into a single long fin. Thoracic ventrals ordinarily united and infundibuliform, but in some separated by a disk, and in others by the ordinary scaly integument. Head unarmed by serratures or spinous points; branchiostegals five. Bodies scaly. No cæcal expansion of the stomach. No pancreatic cæca. A genital papilla in the males, and sometimes in both sexes. Like the Blennies many pass part of the day out of the water, breathing air, and can make considerable way on moist shores, the pectorals serving for feet.

Gobius. *Generic Characters.*—Ventrals united a little posterior to the pectorals into an oblique funnel-shaped hollow; two dorsals, the first shorter, supported by jointless flexible rays. Head of moderate size, rounded; cheeks convex; eyes approximated and prominent; mandible horizontal; teeth villiform or card-like, often with a stronger exterior row: with or without cutaneous filaments or crests on the head. Scales ciliated. No air-bladder.

The species of this genus are easily recognised by the peculiar form of the ventral fins; the short anterior rays, and the long posterior ones, on each side, being united together, making a kind of sucker, with which they have

been supposed to possess the power of attaching themselves to rocks. The Gobies are of little value, except as supplying food to other fishes. Of this genus the Black Goby is one of the most rare on our shores.

This species appears to be an inhabitant of the rocky parts of our coast chiefly, and on that account is not so frequently taken by the net: it is, however, sometimes captured in that manner on the coast of South Devon, particularly in the estuary of Kingsbridge, from whence, says Colonel Montagu, we have obtained several specimens of tolerable size, the largest about five inches.

"The head is large, the cheeks inflated, and the lips very thick; the wide mouth is furnished with numerous small and very short teeth in several indistinct rows in both jaws, the under jaw being roughened by them like a rasp: the eyes are high up on the head, and approximate; the upper part of them dusky, partaking of the colour of the head, the lower part of the irides golden: between the eyes are two small pores, the anterior one more than double the size of the other, but not distinguishable without the assistance of a lens: the nostrils are placed before the eyes, on the outside of each of which is a small fleshy appendage, rather elevated. The cheeks and opercula are studded with rows of very minute papillæ, which appear like spines: most of these rows are vertical, but some run longitudinally, and are observable only with the aid of a lens. On the top of the head a furrow runs back to the first dorsal fin. The colour is uniformly dusky in the more matured fishes, except from the chin to the vent, which is whitish, with some deep purplish black between the gills beneath; the ventral fins are more or less black. When fresh, the fish is covered with a thick mucous secretion; but after having been in spirits, it becomes extremely rough to the touch if rubbed the

reverse way. This roughness is occasioned by the scales, which are large in proportion, and ciliated at their free edges."

"The ventral fins, which supply the great generic character, are connected, forming a funnel-shaped member of twelve branched rays; and the anus is furnished with an elongated tubercle. We never could discover that the Black Goby entered into fresh water, and with us it certainly spawns in the sea. With respect to the union of the ventral fins, it would seem to be for the purpose of forming an instrument of adhesion; but in no instance have we observed that these fish stuck either against rocks or to the bottom of the glass vessel in which they have been kept alive for several days."—*Montagu's MS.*

The numbers of the fin-rays are—

D. 6. 17: P. 17: V. 12: A. 12: C. 15.

The lower jaw is the longest, with fine card-like teeth in several rows; the tongue is square at the end; the gill-apertures small; behind the vent there is a small conical tubercle. The adult fish are from five to six inches in length. They spawn in May or June, depositing the ova on stones. The young are to be seen in summer, and are lighter in colour, particularly on their under surface.

BLACK GOBY.

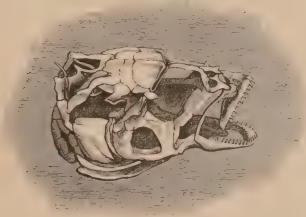
UNITED VENTRALS AND ANAL PAPILLA.

They frequent various parts of the coast from Cornwall to the Orkneys. Mr. Couch has observed that the Black Goby, like the Shanny, carries off its prey in its mouth to a resting-place, and there struggles with it.

The Black Goby, because of its inhabiting the rocky parts of our coast, is called Rock Goby and Rock-fish, to distinguish it from the other British species, which frequent sandy bays. This Goby, as observed in a vivarium, keeps ordinarily its gill-cover closed against the bones of the humeral chain, but respires water through a small circular opening left at the upper angle of the operculum. The soft edges of this opening are in constant motion. The use of the anal tubercle is only conjectured. This is one of the species which has the habit of constructing a nest.

The *Gobius niger* of Donovan and Fleming appears to be distinct from the *G. niger* of Linnæus and the *Histoire des Poissons*, and to be identical with the *G. bipunctatus* of this work. Mr. Thompson also considers the British Black Goby to be distinct from the *niger* of Cuvier and Valenciennes, and enters into a lengthened comparison of their characters in his Natural History of Ireland.

SKULL OF THE BLACK GOBY.



THE DOUBLY-SPOTTED GOBY.

Gobius Ruthensparri, Cuv. et Valenc. Poiss. t. xii. p. 48.
,, ,, *Double-spotted*, G. Thomps. N. H. of Irel. iii. p. 115.
,, *bipunctatus*, Yarrell, Brit. Fishes, vol. i. p. 255.
,, *niger*, *Black Goby*, Donov. Brit. Fish. pl. 104.
,, ,, ,, ,, Flem. Brit. An. p. 206, sp. 117.

The little Goby which forms the subject of the present article has been confounded with *Gobius niger* by some authors, and by others has not been distinguished from *Gobius minutus*. As it is not uncommon, it has been obtained by various collectors, and few that have had the opportunity of comparing it side by side with *G. niger* and *minutus*, but have been convinced that it was distinct from both. I therefore ventured to propose for it the name which its two conspicuous and constant spots on each side suggested, till the publication of the twelfth volume of the *Histoire des Poissons* revived the name which had been previously applied to this species by Euphrasen.

I have received specimens from Belfast, by the kindness of William Thompson, Esq., who considered it to be a distinct species, and had publicly noticed the differences existing between it and the two Gobies that had pre-

viously been considered as our only indigenous species; and it has been sent to me from Holyhead and Cornwall: I have taken it myself on the coast of Dorsetshire, and have obtained specimens from Berwick. Dr. Parnell has met with it in the Firth of Forth, where it frequents rocky situations, living among *fuci*, and is not observed to repose on sandy bottoms like most of the other species. Mr. Thompson has ascertained that this Goby is found also on the south-west coast of Scotland.

The length of the specimen now described was two inches and one-eighth; the upper part of the head and nape is flattened; the eyes are large and lateral; the mouth large, with the gape slanting obliquely upwards, the angle depressed, and the mandible much the longest when the mouth is opened; both jaws furnished with numerous slender, sharp teeth, curving inwards.

The numbers of the fin-rays are as follow:—

D. 7. 12: P. 15: V. 12: A. 12: C. 11.

The first dorsal fin commences a little in advance of a conspicuous dark spot on the side just behind the pectoral fin; the second dorsal fin commences over the vent: all the rays of both dorsal fins are slender and flexible. The pectoral fin is large, and when spread covers, but being transparent does not conceal, the dark spot on the side; the ventrals arising a little behind the origin of the pectorals, are united, their longest rays reaching considerably beyond those of the pectoral fins. The vent and its tubercle are under the commencement of the second dorsal fin; the rays of the anal fin possess the same slender, flexible character as those of the dorsal; the tail is nearly square, and has a conspicuous dark spot on the base of the caudal rays.

The prevailing colour of the head and upper parts of the body is a nutmeg-brown, produced by a double series of diagonal lines taking opposite directions; the under aspect of the head, body, pectoral and ventral fins, is very pale brown, almost white.

The two spots on each side, and the darker brown colour, distinguish this species from *G. minutus*.

Mr. Alfred Roberts, Curator of the Scarborough Museum, states that the female of this species is fully one-third larger than the male, and has only one spot on the base of the caudal fin, while the males always have two. This he ascertained by having bred the fish in confinement, and by the observations of several successive years. He says that when the female had deposited her eggs in the shell of a Barnacle, the male took possession of the deposit and was continally working his fins in and out of the shell, and drove other fish away. On the sixteenth day the young brood were hatched, but were destroyed by the other fish in the vivarium.

THE FRECKLED GOBY, OR SPOTTED GOBY.

CRAIGBYSG BRYCH, *Wales.*—POLEWIG, *Thames.*

Gobius minutus, Cuv. et Valenc. Poiss. t. xii. p. 39.
" " *Bouleau blanc*, Cuvier, Règne An. t. ii. p. 243.
" " *Spotted Goby*, Penn. Brit. Zool. vol. iii. p. 290, pl. 41.
" " " " Donov. Brit. Fish. pl. 38.
" " " " Flem. Brit. An. p. 206, sp. 118.
" " " " Jenyns, Brit. Vert. p. 386.
" " " " Thompson N. H. of Irel. iii. p. 116.

The Spotted Goby of Pennant and others, which ought rather to be termed the Freckled Goby, is not only common on all our sandy shores, where it is constantly to be obtained of the shrimpers in whose nets it is taken, but is also most plentiful in the Thames, where it is known to the fishermen by the names of Polewig, or Pollybait: the larger-sized specimens being taken to sea by the line fishermen to be used for bait.

The length of the adult is usually about three inches; the head is large; the eyes are near the upper surface and closely approximating, the irides blue; the mouth is wide, and is furnished with numerous small pointed teeth in several rows, curving inwards: the dorsal fins are well apart, the rays slender and flexible, and the anterior rays of the second dorsal fin are rather longer

than the posterior ones; the pectoral and ventral fins are large; the vent is placed just half-way between the nose and the end of the fleshy portion of the tail; the anal fin ends nearly on the same plane with the second dorsal; the tail is nearly square, or but very slightly rounded.

The prevailing colour of the body is a yellowish-white, minutely freckled over with pale ferruginous markings, and occasionally showing a row of larger spots along the lateral line; the tail is slightly barred by lines formed of minute spots.

The numbers of the fin-rays are—

D. 6. 12: P. 20: V. 12: A. 13: C. 12.

This species is found in Cornwall, on the west and east coasts of Scotland, and on both sides of Ireland plentifully. Mr. Thompson remarks that the dorsal fin has sometimes a rosy hue, in which state the fish has been mistaken for the *Gobius reticulatus* of Cuvier and *Valenciennes*.

THE ONE-SPOTTED GOBY.

Gobius unipunctatus, One-spotted Goby, Parnell, Memoirs of the Wernerian Nat. Hist. Soc. vol. vii. p. 243.
,, ,, ,, ,, Thompson, N. H. of Irel. iii. p. 117.

This Goby, says Dr. Parnell, "does not appear to have been noticed by previous authors. I have observed it in most of the sandy bays in the Firth of Forth; but in greater numbers, and of larger size, in the neighbourhood of the salmon-nets above South Queensferry, where it may be found throughout the summer months in water from two to three feet deep. I found it on the south coast of England, to be equally common with the *Gobius minutus*, or Freckled Goby. I have also captured it in many situations where the *minutus* was not seen; and the *minutus* has been taken in many places where the *unipunctatus* did not exist. The most northern locality in which it has yet been observed, appears to be the Moray Firth, where James Wilson, Esq. obtained a fine specimen of three and a half inches in length."

"This fish, although closely allied to the other species of the same genus, is undoubtedly quite distinct from them; the black spot on the first dorsal fin being far more constant and conspicuous than any character which

distinguishes the rest of the British Gobies. The only species it can well be mistaken for is the *G. minutus*, but it differs from that in having a black spot between the fifth and sixth ray of the first dorsal fin; in the eleven rays of the second dorsal, and in the tail-fin, being even at the extremity: whereas the *G. minutus* has no black spot between the fifth and sixth ray of the first dorsal fin; the rays of the second dorsal are only ten in number, and the tail-fin is rounded at the end."

Instead of a repetition of Dr. Parnell's description given in the second edition of this work, the following account of a specimen taken in the Solent by Mr. Charles Barron, is substituted.

The length of the specimen is a little less than two inches, of which the head does not make quite a fourth part, and the greatest height at the shoulder is only between a sixth and a seventh of the length. The dorsals are nearly equal in height, a small space intervenes between them; and the part of the tail intercepted between the second dorsal and the caudal is about one-sixth of the whole length. The eyes nearly touch each other on the top of the head, and they are about their own diameter from the extremity of the upper jaw. There are no scales visible on the head nor any perceptible rows of pores. The teeth on the jaws are acutely subulate, somewhat unequal, and disposed irregularly, six or seven in the antero-posterior depth of the jaws, the bands retaining their width to the corners of the mouth. On the mandible the dental surface is convex, and on the premaxillaries slightly concave. The mandible projects a little beyond the premaxillaries. The front of the ventrals is under the axillæ of the pectorals, and the heights of the vertical fins do not quite equal the greatest depth of the body.

The scales, small and delicate, are pretty objects in a microscope. Their form closely resembles the valve of a cardium, the hinge of the shell representing the uncovered edge of the scale, which is furnished with a regular row of twenty-four subulate teeth. This edge is bounded by a flat ogee curve, and the point round which the lines of structure circulate, is very near the apex of the curve, and close to the posterior edge of the scale. The rest of the scale is bounded by two-thirds of an oval curve, whose vertical diameter rather exceeds the antero-posterior one. It is traversed by from sixteen to twenty radiating grooves, separated by ridges which are indented by the crossing lines of structure. This is a description of several of the lateral scales of the fish.

Dr. Parnell states that the colour of the fish when newly taken from the water is pale brownish-yellow; the throat and belly white, and the dorsal and caudal fins freckled and barred with brown: the lateral line is crossed by seven dark spots, the one at the base of the caudal being the most conspicuous. Mr. Barron's specimen has all these marks, as well as the black spot on the posterior part of the first dorsal. As preserved in spirits, the pectorals and ventrals have a blackish-grey tint. Rays:—

B. 5: D. 7—1+9: A. 1+9: P. $17\frac{6}{6}$. V. 1+5.

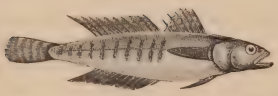
Dr. Parnell counted only six spines in the first dorsal of his specimens and eleven rays in the second dorsal and anal, having perhaps reckoned the posterior division of the last ray as a distinct one. It would appear that the dorsal fin-spot is occasionally absent, as a second specimen taken by Mr. Barron, along with the one described above, wants it, and is otherwise lighter in colour, but presents no tangible difference of form.

Mr. Thompson mentions that he has obtained this

species on the north-east coast of Ireland, that Dr. Allman had found it at Glendore in the south of the island, and that Dr. Drummond had taken it at Port Bannatyne in the Clyde. Mr. Gurney, in the Zoologist (3058), records the capture of a specimen on the Norfolk coast.

This Goby resembles the Mediterranean *Gobius Coulonianus* of Risso, figured in the *Histoire des Poissons*, under the name of *Colonianus* (pl. 345), but the fins are less tall. The dorsal spot is similar in both. It should be carefully compared at different stages of growth with *Gobius minutus*, which it closely resembles in general form; and M. Valenciennes says, that *G. minutus* has often a black spot between the last two rays of the first dorsal. Mr. Thompson was inclined to believe that the *G. unipunctatus* and *minutus* were the same species.

A NEWHAVEN FISHWOMAN.



THE SLENDER GOBY.

Gobius gracilis, Slender Goby, Jenyns, Brit. Vert. p. 387.
,, ,, ,, ,, Parnell, Wern. Mem. vol. vii. p. 245.
,, ,, ,, ,, Thomps. N. H. of Irel. iii. p. 116.

I have been favoured by the Rev. L. Jenyns with the following particulars of another species of Goby.

"Length three inches two lines. Form closely resembling that of *G. minutus*, but more elongated and slender throughout; greatest depth barely one-seventh of the whole length; snout rather longer; operculum approaching more to triangular, the lower angle being more cut away, and the ascending margin more oblique; a larger space between it and the pectorals; rays of the second dorsal longer and gradually increasing in length, instead of decreasing, as in *minutus*, the posterior ones being the longest in the fin, and rather more than equalling the whole depth: rays of the anal fin in like manner longer than in *G. minutus*. The fin-rays are—

D. 6. 12: P. 21: V. 12: A. 12: C. 13.

In all other respects similar."

"Apparently a new species, though probably of not less frequent occurrence than the Spotted Goby, with which it may be easily confounded. My specimens were

obtained from Colchester, and were supposed to have been taken somewhere off the Essex coast."—*Jenyns' MS.*

Dr. Parnell says, "This well-marked Goby is occasionally found in the Firth of Forth, but is not common; it inhabits the same situations as the *minutus*, and they are frequently taken together. I have found it in the Solway Firth, and in much greater plenty on the southern coast of England. It spawns in June, and is of little value except as food for other fishes and aquatic birds." I have also obtained this species from our southern coast; and Mr. Thompson has procured two examples from the coasts of Down and Louth in Ireland.

LINDISFARNE, OR HOLY ISLAND.

The tide did now its flood-mark gain,
And girdled in the Saint's domain:
For, with the flow and ebb, its style
Varies from continent to isle.—WALTER SCOTT.

THE WHITE GOBY.

Gobius albus, The White Goby, Parnell, Transactions of the Royal Society of Edinburgh, vol. xiv.
" " " " Supplt. to first ed. of Hist. Brit. Fish. p. 27.

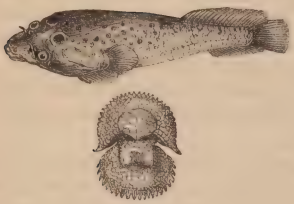
This species of Goby, Dr. Parnell observes, "holds such a conspicuous place in the genus, that it cannot well be mistaken for any other. I first noticed it in the Solway Firth, in June 1836, where I obtained in one day, after the recess of the tide, fifty specimens. They are evidently the fry of a large species. When first taken from the water they are soft and transparent; the eyes are large and prominent; the scales which cover their body are large, thin, and very deciduous. The length is about two inches; the head is large; the gape is wide; the teeth are long and sharp, placed in a single row in each jaw. The first dorsal fin commences over the anterior third of the pectorals; the second dorsal fin commences over the vent, and ends opposite to the base of the last anal rays. The cheeks are tumid; the border of the operculum rounded; the body is transparent, and marked by a number of fine depressed lines, placed in an oblique direction; the lateral line is straight throughout its length. The numbers of the fin rays are—

D. 5. 13: P. 16: V. 13: A. 13: C. 12.

The last ray of the anal and second dorsal fin is longer than the first, and reaches, when folded down, to the base of the tail rays. These fishes are supposed (erroneously) by the fishermen to be the young of the Sting-fish, *Trachinus vipera*, and are consequently destroyed whenever they come within their reach. On transferring them to a bottle of alcohol they lose their transparent aspect, and become hard and opaque. In the month of July, when I had occasion to revisit the Solway Firth, I endeavoured to obtain additional specimens, presuming that by this time they would have somewhat increased in size; but not a single specimen could be found, nor has the parent fish ever come within the observation of the fishermen.

"The first dorsal fin of this fish, as possessing but five rays, is sufficient to distinguish it from every other British species of the same genus."

The teeth in this species are also more formidable in proportion to the size of the fish than those of any other British Goby.



THE CORNISH SUCKER.

MOR LEIAF, *Wales.*

Lepidogaster Cornubiensis, JENYNS, Man. Br. Vert. 469.
,, *biciliatus*, *Ocellated Sucker*, RISSO, Hist. iii. p. 272.
Cyclopterus Lepidogaster, *Jura Sucker*, PENN. Brit. Zool. iii. pl. 25.
,, *ocellatus*, *Ocellated Sucker*, DONOV. Brit. Fish. pl. 76.

GOBIESOCIDÆ. *Family Characters.*—A double or single subbrachial disk, capable of being used as an adhesive sucker, bordered by the ventrals: one or two dorsals, no distinctly spinous rays; no scales. Müller merges this family in the GOBIIDÆ.

LEPIDOGASTER. *Generic Characters.*—Disks binate; posterior one under the pubic bones, embraced by the otherwise little-developed ventrals, the contiguous but anterior one less complete and formed by the large lower rays of the pectorals under the coracoid bone. Head large and depressed, mouth projecting, protractile; teeth minute; gill-openings restricted; branchiostegals four or five. Dorsal single, supported by jointed rays only, and opposed to the anal fin. Intestine straight and short: no pancreatic cæca. No air-bladder.

BARON CUVIER has called this family *Discoboles*, on account of the disk formed by the union of the ventral fins.

The species belonging to this small family are very remarkable for the power they possess of attaching them-

selves to stones, rocks, or other substances, by means of the adhesive disk on the under surface of their bodies. The two British species of the first genus are small, defenceless, their bodies smooth, without scales; and the power of attaching themselves to stones, which they exercise, may be useful in enabling them to resist the action of strong currents or dashing waves, and is perhaps applicable to other uses, with which naturalists are not yet acquainted.

The Cornish Sucking-fish was discovered by Dr. Borlase, who described it under the name of the Lesser Sucking-fish, in his Natural History of Cornwall. Pennant afterwards found it at Jura, in the Hebrides, and called it after that island; but, if any geographical name is admissible, it ought to have been that only where it was first discovered; and I have therefore followed Dr. Fleming and Mr. Jenyns in calling it the Cornish Sucker, although this name is not entirely free from objection, two other species of fishes, provided with suckers, being found in Cornwall. Mr. Couch says, however, that this fish is there called pre-eminently the Sucking-fish by fishermen, from the readiness with which it adheres to any substance, and even to the hand that seizes it,—a habit which has been noticed by Colonel Montagu also. "It is sluggish, but seems to wander, since it is sometimes abundant, and at others rare. Its usual haunts are about low-water mark, where it is often left by the tide, concealed beneath a stone. I find it," says Mr. Couch, "large with spawn in March. Its food is crustaceous animals and marine insects, which it swallows entire."

Various examples of this species have been found on the north-east and west coasts of Ireland, as mentioned by Mr. Thompson.

The whole length of the specimen described was two

inches and a half, and the distance from the point of the nose to the end of the gill-cover was equal to one-third of the length: the head is depressed; the mouth produced, very much flattened, and narrower than the head; therefore aptly called spatula-like; the gape is elongated: numerous small teeth form bands in both jaws: the under surface of the head is very flat; the first sucking disk is situated before and the second disk behind the opening of the gill-cover: before the inner corner of each eye there is a small flattened nasal filament, about equal in length to the diameter of the eye itself, followed by a second, but much shorter one: both are of a bright carmine colour; behind the eyes, which are widely separated, there are two distinct, red, eye-like spots. The dorsal fin commences about half-way between the eyes and the end of the rounded caudal; the anal begins still nearer the caudal fin, and both are joined to it by a membrane. The posterior part of the body is compressed. The pectoral fin is large, with four stronger rays beneath, which, with the connecting membrane, form the sides of the anterior disk; an extension of the membrane only, without rays, being continued across the front. Immediately behind the broad swimming portion of the pectoral fin on each side, a membrane arises in the same vertical position, which, joining the united ventral fins, forms the fore edge of the second disk, the rays of the two ventrals occupy the posterior border of the second disk, and the continuation of the connecting membrane completes the circle.

The fin-rays are—

D. 18: P. 19: A. 10: C. 18.

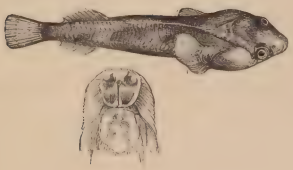
The general tint is a pale flesh-colour, with spots and patches of carmine about the upper and under surface of

the jaws, around the eyes, on the top of the head, sides of the body, and abdomen. The description was taken from the largest of five specimens, on three of which the spots behind the eyes were conspicuous, but they were wanting in the other two.

The Ordnance Survey of the County of Londonderry mentions that two specimens of a rich blue colour, with deeper tinted post-ocular spots, were received from Portrush.

The vignette below represents a man fishing for prawns on a rocky coast. The fisherman deposits around him eight or ten hoop-nets, each baited with a piece of stale fish: a large bung, by way of a buoy, is attached to each hoop. The man, with a long forked stick, raises the nets in succession, by putting the fork of the stick under the bung, and deposits them again after examination.

PRAWN FISHER.



THE BIMACULATED SUCKER.

Lepidogaster bimaculatus, Bimaculated Sucker, Flem. Brit. An. p. 190, sp. 72.
Cyclopterus ,, ,, ,, Penn. Brit. Zool. iii. 182, pl. 25.
,, ,, ,, ,, Donov. Brit. Fish. pl. 78.
,, ,, ,, ,, Montagu, Linn. Tr. vii. 293.

This very distinct species was first described by Pennant from a specimen sent to him by the Duchess of Portland, which was got at Weymouth. It has since been taken by Mr. Donovan on the coast of Kent; by Professor Henslow at Weymouth; by Colonel Montagu in Devonshire, and at two different localities in Cornwall, Polperro and Penzance. It has also been captured by Mr. William Thompson of Belfast, when dredging in deep water for shells on the eastern and western coasts of Ireland; as well as by Dr. Ball and Messrs. Hyndman and Templeton, as mentioned in Thompson's Natural History of Ireland, where the existence of it in Loch Ryan in Scotland is also mentioned. Colonel Montagu, by deep dredging at Torcross, obtained it adhering to stones and old shells, and kept some specimens alive for a day or two in a glass of sea-water.

"In this situation they always adhered to the sides of the glass by the apparatus termed the sucker, and frequently remained fixed till they died; and even after death the power of adhesion continues, the wet finger being applied to the part, the fish becomes suspended: when alive they instantly attach themselves to the hand if taken out of the water."—*Linn. Tr.*

In June Mr. Hyndman dredged a bivalve shell containing the ova partially hatched with the young and the parent fish of this species off the county of Down, and in Belfast Bay. The ova were very large, and closely covered the surface of the shell to the extent of a square inch.—*Nat. Hist. of Ireland.*

Mr. Couch says it keeps in deeper water than the preceding species; but is occasionally found under stones at low-water mark.

In this species, of which I possess several examples, varying in length from three-quarters of an inch to one inch and three-quarters in length, the head is depressed, and the posterior portion of the body compressed; the head is shorter, compared to the whole length, than in the preceding species, and the mouth wider, but the jaws not so much produced; the teeth are similar; there are no nasal filaments; the irides are pink and gold; the pupils blue: the stout rays at the inferior part of the pectoral fin, and the connecting membrane on each side, making up the lateral portions of the anterior disk, are much longer: the ventral fins that form the sides of the second or posterior disk are also elongated; the dorsal and anal fins are of equal size, opposite each other, short, and placed far back; commencing and ending on the same planes: not connected with the caudal, there being a considerable space between the elongated caudal and the other two vertical fins.

The fin-rays in number are—

D. 6 : P. 19 : A. 6 : C. 10.

The general colour is carmine red, fading to pale flesh-colour underneath, with a light-coloured patch between the eyes, and otherwise liable to some variation in the markings: the two spots on the sides are not always very obvious, and young specimens are without them.

THE CONNEMARA SUCKER.

Lepidogaster cephalus, Thomps. Nat. Hist. of Irel. iii. p. 214.

The authority for this species is a specimen, which was taken in Roundstone Bay, Connemara, on the western coast of Ireland, and is preserved in the collection of the late Dr. Ball of Dublin. It has not been observed on the English coasts, nor has any drawing been made of it to which we have access. Mr. Thompson published an account of it in the Annals of Natural History (iii. 34), which has been reprinted in the posthumous edition of his work above quoted. The following passages are extracted from his paper.

"This fish equals *Lepidogaster Cornubiensis* in size, but differs from it in the dorsal and anal fins occupying a considerable portion of its length, and in having a greater breadth of head with a narrower snout: the body likewise is more depressed, and narrows more suddenly behind the ventral disk into the tapering tail. Its specific

characters are—a very minute cirrus before each eye; dorsal and anal fins unconnected with the caudal; ventral disk small.

Br. 5: D. 15: A. 10: P. 25 and 4: C. 15 conspicuous, 20 in all.

"Head very broad posteriorly, forming more than one-third of the entire length; in front of each orbit, and on a line with its upper border, there is a cirrus so minute as to be scarcely visible without the aid of a lens; eyes large, two of their diameters apart; teeth pointed and numerous on the jaws, the outer premaxillary ones being the largest; gill-opening small; ventral disk smaller, and different from that of *L. Cornubiensis*. Dorsal fin originating behind the middle of the fish, and continued to near the caudal with which it does not unite; anal fin commencing farther back, but reaching as far, the last rays of the two fins, when laid down, touching the base of the caudal: rays of all the fins jointed, but not branched: vent situated midway between the posterior edge of the ventral disk and the end of the caudal fin: a short anal tubercle."—*Thompson, l. c.*

The *Lepidogaster Webbianus* of Valenciennes, which inhabits the seas of the Canary islands, has two cutaneous filaments at the nostrils on each side, and so has also the *L. zebrinus* of Lowe, which inhabits the Madeira coasts, and is perhaps the same species with *Webbianus*. The *Lepidogaster chupasangue* of the same seas, which Mr. Lowe thinks may be *L. Decandollii* of Risso, has no nasal cirrus, and the vertical fins are not connected to each other.

THE LUMP SUCKER.

SEA-OWL, COCK AND HEN-PAIDLE. JAR-FOR, *Wales.*

Cyclopterus lumpus, Linnæus. Bloch, pt. iii. pl. 90.
,, ,, Cuvier, Règne An. t. ii. p. 346.
Lumpus Anglorum, Willughby, p. 208, N. 11.
Cyclopterus lumpus, *Lump Sucker*, Penn. Brit. Zool. iii. p. 176, pl. 24.
,, ,, ,, ,, Donov. Brit. Fish. pl. 10.

Cyclopterus. *Generic Characters.*—An oval, pubic, sucking disk, embraced behind by the ventrals and in front by the lower lobes of the pectorals, which unite under the throat. Mouth large, teeth on the jaws and pharyngeals small and pointed: opercula small, gill-openings closed below; branchiostegals six. Skeleton but slightly osseous; skin viscous, with rows of bony tubercles and imbedded hard grains. Body short, high, and thick. Two dorsals, the first of simple rays hidden under the skin of the adult fish, the second of branching rays opposed to the anal. Stomach pretty large; many pancreatic cæca and a long intestine.

The Lump Sucker is remarkable for its very grotesque form, while from the large size of its body, both as to depth and thickness in reference to its length, and the comparatively small size of its fins, it appears calculated to make but slow progress through the water.

It is more plentiful northward than on our southern coast, and beyond this country has a most extensive range. Pennant includes it in his Arctic Zoology. It is caught on the coast of Greenland, where it is eaten; and the Lump Sucker of the North-American shores is apparently identical with our own. Professors Nilsson and Reinhardt include it among the fishes of Scandinavia; and Mr. Low considers it to be a common fish in the Orkneys. Dr. Neill says that in the spring months it is caught on the sands of Portobello, and sent for sale to the Edinburgh market, where it is purchased for table, and the male fish considered superior to the female. "If," says Dr. Richardson, "the authority of Sir Walter Scott is to pass current in gastronomy, the Lump, or Cock-paidle, as it is named in Scotland, is a fish of good quality, for he makes Mr. Oldbuck give the same price for one that he does for the Bannockfluke, or Turbot. The epithet of Cock-paidle seems to have originated in the appearance of the elevated dorsal ridge, which is enveloped, like the rest of the fish, in a thick, tuberculated skin, with some resemblance to the comb of a domestic cock." Along our eastern and southern coasts it is also taken more exclusively during spring, when it approaches the shore for the purpose of depositing its spawn, which happens in April, or the beginning of May. This species has also been taken all around the Irish coasts.

Some of our fishermen consider that we have on our coast two species of Lump-fish, which they distinguish by the names of Red-Lump and Blue-Lump, considering the first only as eatable; but the difference in colour, and also in the quality of the flesh, is only the effect of season; the fine external colour, as well as the firmness of the flesh, being lost to the fish for a time by the ex-

hausting process of spawning; it is then the Blue Lump, and reckoned by the fishermen to be worthless. The ova forming the hard roe are of large size, and of a fine reddish-orange colour. Mr. Thompson thinks that the differences of colour are sexual distinctions, the *Red Lump* being the male and the *Blue Lump* the female.

Fabricius speaks of the Lump-fish "as approaching the rocky bays on the Greenland coast in the months of April and May for the purpose of spawning. The female precedes, and deposits her roe among the larger algæ, and in fissures of the rocks; the male shortly follows, and fructifies the eggs, adhering so closely to the mass of roe, that the impression is left upon the hollow surface of the shield formed by the ventrals; after which he keeps watch over the sacred deposit, and guards it from every foe with the utmost courage. If driven from the spot by man, he does not go far, but is continually looking back, and in a short time returns. Even the well-armed Wolf-fish hazards his life if he approaches the Lump's nest; for this creature, notwithstanding the smallness of its teeth, is capable of attaching itself to its adversary's neck, and inflicting thereon a mortal wound." This account by Fabricius has been doubted by Lacépède, but receives confirmation in part from the observations of others.* Dr. George Johnston, in his list of the fishes of Berwickshire, says, "The Cock and Hen Paidle spawn toward the end of March and in April. At that season the Hen approaches the shore and deposits her spawn among the rocks and sea-weed within low-water mark, and immediately afterwards returns to deeper water. The male then covers the spawn, and, according to the testimony of our fishermen, remains covering it, or near it, until the ova are hatched. The young soon after birth

* See Zoologist for 1851, p. 3157.

fix themselves to the sides and on the back of their male parent, who sails, thus loaded, to deeper and more safe retreats. He is only half the size of the Hen; and at the breeding season his belly becomes of a reddish colour. The spawn of a single female will fill a large basin, and is of a beautiful pink colour: the eggs are globular, and about the size of swan shot. Not in use as food, but the Cock especially is reported to be excellent when fried or baked."

The young are four inches and a half long, and three inches in height by the end of November. Shaw's specimen, of six inches in length, to which he attached the specific name of *pavonina*, is only a young fish of our common species, which for want of sufficient age had not attained its perfect colour. The simple rays of the first dorsal frequently pierce through the skin, and altering the appearance of the fish, have suggested the notion of another species; the young have also, from differences depending upon their age and condition as fry, been considered specifically distinct, and thus the terms *pyramidalis*, *minutus*, and two or three other names, have arisen. Mr. Thompson says that when the young are about an inch in length, the dorsal crest is membranous, and serves all the purposes of a fin. As the Lump-fish is retentive of life, its power of adhesion is sometimes made the subject of experiment. Pennant informs us, "That on putting a fish of this species, just caught, into a pail of water, it fixed itself so firmly to the bottom, that on taking it by the tail, the whole pail by that means was lifted, though it held some gallons, and that without removing the fish from its hold."

The Lump-Sucker feeds principally on young fish, of which it devours a large quantity. Mr. Couch says that it sometimes takes a bait, and he has found in its stomach

various *onisci*. It is itself preyed upon by the Seal, who, according to a communication from J. H. Gurney, Esq., to the Zoologist (3157), peels off the loose skin before he devours the body.

In the month of March the colours of the Lump-fish are in the highest perfection, combining various shades of blue, purple, and rich orange; it is then frequently to be seen in the shops of London fishmongers, suspended by the middle of the back, attracting attention from the combination of a singular form with brilliant colours.

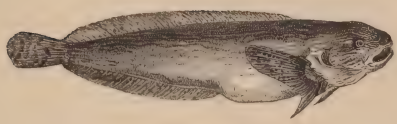
A specimen sixteen inches long is usually about eight inches deep, and four inches wide: the length of the head is about one-fourth of the whole length of the fish; the descending line of the profile of the head is abrupt, and the back is highly arched and somewhat compressed, forming a ridge, with a row of tubercles along the upper edge; on cutting through the integument, this ridge is found to be supported by several undivided rays, which sometimes, from abrasion of the hard skin, appear externally. Behind this central ridge, and over the last third portion of the curve of the dorsal line, is the soft dorsal fin, the length of the base of which is about equal to the length of the longest of its rays; the pectoral fins descend low on the sides, and, passing forwards, enclose the adhesive disk which extends from the edge of the membrane connecting the branchiostegals, to under the posterior angle of the operculum: the union of the ventral fins completes the disk posteriorly. The anal fin is under or opposed to the soft dorsal, and is of nearly the same size and shape; the tail fin is of moderate size.

D. 11: P. 20: A. 9: C. 10.

Each of the rays is furnished with a row of hard tubercles along a considerable portion of its length, and the whole surface of the head and body is covered with

small bony tubercles, most of which are more or less stellated in form. Along several parts of the body are rows of larger and more prominent tubercles, with surfaces minutely granulated; one row occupies the central ridge of a portion of the back; two or three tubercles are placed on each side just in advance of the dorsal fin; one long straight row extends from the upper angle of the operculum to the upper base of the caudal fin; a second long row reaches from the shoulder over the pectoral fin to the lower base of the same fin; and a third row of large size extends along the abdomen on each side as far as the commencement of the anal fin.

The mouth is wide; the lips fleshy; the lower jaw the longest: a band of short and small teeth arms each jaw: there is a small patch of rounded teeth on the root of the tongue, with others at the pharynx: the irides are of a fine red; the sides of the head and body, and all the upper parts present varying shades of dark blue, lighter blue, and purple; the lips, under surface of the head and body are of a fine orange, and all the fins are tinged with the same colour. After the season of spawning is over, much of this brilliant colouring is lost for a time.



THE UNCTUOUS SUCKER, OR SEA-SNAIL.

MÔR-FALWEN, *Wales.*

Liparis vulgaris, *Sea Snail*, Flem. Brit. An. p. 190.
,, ,, Cuvier, Règne An. t. ii. p. 346.
,, *nostras*, *Sea Snail*, Willughby, App. p. 17, H. 6, fig. 1.
Cyclopterus liparis, Linnæus. Bloch, pt. iv. pl. 123, fig. 3.
,, ,, *Unctuous Sucker*, Penn. Brit. Zool. iii. 179, pl. 24.
,, ,, ,, ,, Donov. Brit. Fish. pl. 47.
,, ,, *Sea Snail*, Jenyns, Brit. Vert. p. 473.

Liparis. *Generic Characters.*—Body elongated, compressed behind the vent. Skin soft and slippery. An elongated dorsal fin, corresponding posteriorly to the anal, both united to the base of the caudal. Ventral disk single, oval or round and concave, fringed by the rays of the ventrals, and of the lower part of the pectorals.

The Unctuous Sucker, or Sea-Snail, so called from the soft and slimy surface of its body, appears to be much more common in the northern parts of the British Islands than in the southern. Mr. Scoresby, and other observers, have even found it as far north as Nova Zembla and Greenland; and specimens of it were taken in the trawl-net on the west coast of Davis's Straits during the first Arctic voyage of Captain Sir Edward Parry.

This species is found on the Berwickshire coast; and Dr. Parnell has obtained specimens in the Frith of Forth. Mr. Low says, "The Sea-Snail is found under stones at

many places in Orkney; but in no place more frequently than that at the point of the Ness of Stromness, where they may be picked up by dozens." Yet it does not appear to be mentioned by Professor Nilsson or Reinhardt in their accounts of the fishes of the Scandinavian shores; nor is it included by Linnæus in his *Fauna Suecica*.

Mr. Donovan obtained a specimen from among a parcel of Sprats at Billingsgate fish-market: and those who recollect the wholesale mode of fishing for Sprats, practised by the stow-boatmen, as described at page 118 of our first volume, will not be surprised that many rare and curious fishes of small size are caught with the Sprats. It is also obtained on the southern coast, under stones, and in small pools of water left by the ebbing tide. Dr. MacCulloch says this species ascends rivers from the sea to deposit its spawn, and is frequently found near the mouths of rivers. Pennant observes that it is full of spawn in January, and that the matured ova are very large. It feeds on aquatic insects, testaceous animals, and very small fishes.

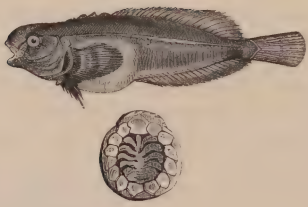
The whole length of the specimen described was four inches, which is the common size of the adult of this species; but it is said to grow much larger in the Northern Seas: the head forms about one-fourth of the whole length; the eyes are widely separated, and the space between them is depressed; the nose is blunt; the lips thick and fleshy, and the mouth wide, but not deeply cleft; the teeth are very numerous, and small, with minutely-recurved points, forming a broad rasp-like band in each jaw; the tongue also is broad, and is covered with prominent papillæ; the lower jaw is rather the longest; the gill-openings are placed high up; the body from the shoulder to the caudal fin is compressed, and tapering, and is invested with a thin semi-transparent

loose membrane, which encloses it like a bag, the fixed points being the lines of the dorsal and anal fins; the pectoral fins are large, and the lower lobes descending the side have additional rays like ventral fins, exterior to the sides of the adhesive disk; the belly is tumid; the dorsal fin begins much nearer the head than the anal fin, and both end close to the tail: the caudal rays are rather long and narrow. The fin-rays in number are—

D. 36: P. and V. 32: A. 26: C. 12. Vertebræ 33.

The colour of the body is a pale brown, irregularly striped with lines of a darker colour, which take different directions, and give a variegated appearance to the head, back, and sides; these lines are confined to the outer epidermis, and do not appear upon the more solid integument underneath; in this state some authors have called this species *lineatus*; but these markings are not constant, and many examples are without any streaks or lines, the edges of the dorsal and anal fins only being edged with a darker colour: the tail, and sometimes the pectoral fins, are slightly barred and spotted. When kept in diluted spirits of wine, the coloured lines and characters of the species may be easily preserved; but this fish loses both markings and size if allowed to become dry.

LICENSED TO POACH BY NATURE.



MONTAGU'S SUCKING-FISH.

DIMINUTIVE SUCKER.

Liparis Montagui,	*Montagu's Sucker,*	Flem. Brit. An. p. 190, sp. 74.	
,, ,,	Cuvier, Règne An. t. ii. p. 346, note 2.		
Cyclopterus Montagui,	*Diminutive Sucker,*	Montagu, Wern. Mem. i. pl. 5.	
,, ,,	,,	,,	Donov. Brit. Fish. pl. 68.
,, ,,	*Montagu's*	,,	Penn. Brit. Zool. vol. iii. p. 183.

This species of Sucking-fish, smaller in size than the one last described, was first discovered by Colonel Montagu. A drawing of it was sent by that excellent observer to Mr. Donovan, who was then publishing his Natural History of British Fishes, and with whom the specific name, referring to Colonel Montagu, originated. The first specimen obtained was of very diminutive size. Subsequently Colonel Montagu having acquired various other larger and adult specimens, published a description and figure of this species himself in the Memoirs of the Wernerian Natural History Society, as above quoted.

This fish has since that period been found on various parts of the coast. Mr. Moggridge, in June 1850, sent me a specimen from Swansea. Dr. George Johnston has

obtained it in Berwick Bay; Mr. Thompson procured it on the south-western coast of Scotland, and in Belfast Bay; it has also been taken on every side of Ireland, and it is not uncommon in Cornwall, as well as on the Devonshire coast.

Colonel Montagu says this species inhabits only the rocky parts of the coast, and of course is rarely taken with the dredge. Those obtained by its discoverer were found at exceedingly low tides among the rocks at Milton, on the south coast of Devon. When it is adhering to a rock the body is frequently bent so that the tail is brought close to the head. This habit of curving its body has been observed by all those who have found this fish.

Mr. Couch's notice of it in his MS. is as follows:—"This is a common species in the West of England, where, however, it seems to wander, since at certain times it is much more rare than at others. It possesses considerable activity; and when the tide has ebbed, it is often found concealed beneath a stone, where, when at rest, it usually throws the tail forwards towards the head. I have never seen it adhere to any fixed substance. The young come to life in September."

Montagu's Sucker, in the adult state, is from two inches and a half to three inches long: the body is rounded as far as the vent; the posterior end being somewhat compressed; the head is broad, a little depressed, and inflated about the gills; the mouth moderately large; both jaws armed with several rows of minute teeth: the eyes are small, and placed high; the irides golden; the pupils dark blue, with a single blue line descending from the eye to the angle of the mouth: the operculum is angular; the branchiostegous membrane transparent: the pectoral and ventral fins are united; the first is rounded; in the

last, four or five rays on each side invest the adhesive disk, which is single, small, and circular: an enlarged representation of the Sucker is added to the figure to assist in affording the means of determining the species: the belly is very tumid, and the vent removed far behind the sucker. The dorsal fin commences farther from the head than in the last species; its anterior rays are short, but gradually increase in length towards the tail-fin, the last being rounded off: the anal fin is shorter than the dorsal. The fin-rays in number are—

D. 26: P. & V. 29: A. 24: C. 12.

This description is partly obtained from Montagu's paper.

The prevailing colour is a dull orange, varied with occasional bluish tints; the fins brighter orange-red; the lateral line is perceptible by a lighter-coloured streak; the under parts of the body, and about the throat and sucker, are white, tinged with flesh-colour.

HERRING-BOATS.

MONTAGU'S BLENNY.

Blennius Montagui, Flem. Brit. An. pp. 206 & 207, sp. 121.
,, *galerita*, Montagu, Mem. Wern. Soc. vol. i. p. 98, pl. v. fig. 2.
Diminutive Blenny, Penn. Brit. Zool. vol. iii. p. 277.
,, *Montagui*, Cuv. et Valenc. Poiss. t. xi. p. 234.
,, *galerita*, Jenyns, Brit. Vert. p. 381.
,, *comatus*, Solander MS. Banks. Libr.

Blenniidæ. *Family Characters.*—Longish fishes, with bluntish heads and jugular ventrals of two flexible rays, sometimes with the addition of a spine, more generally without: dorsal single, composed almost entirely of unjointed but generally flexible rays. Skin very muciparous, naked or scaly. The males have a cluster of anal papillæ. Stomach thin, without a cæcal dilatation. No air-bladder.

Blennius. *Generic Characters.*—Body elongated, with a full prominent belly; skin scaleless, soft, and muciparous. Gill openings large; branchiostegals six. Ventrals consisting of two rays externally, but one of them is often divided beneath the skin. Dorsal extending along the whole back; its simple flexible rays sometimes obscurely jointed. Cutaneous filaments are often developed on the head. Mouth small, cleft of the jaws semicircular; teeth uniserial, strong, simple, close set, the row often terminated at the corner of the mouth by a longer or canine tooth. Intestinal canal simple: no pancreatic cæca. Aperture of the ovary situated between the vent and orifice of the urinary canal, destitute of a papilla. The seminal duct of the male issues in a tuft of papillæ.

Some difficulty occurs in reconciling the synonymes of the Blennies of British authors, from the want of correct representations and more detailed descriptions. Five are

figured in the present work; four of them have the line of the edge of the dorsal fin interrupted by a depression, the fifth species has a perfectly-even dorsal, a more elongated slender body, short ventrals, and a longer anal fin.

The fishes of this genus are of little value: they swim in small sculls, feed on minute crustaceous animals, and are remarkably tenacious of life. They are frequently left by the retiring tide, in small pools on the rocky parts of the coast, are active and vigilant in hiding themselves in small crevices or under sea-weed, and remaining concealed till the return of the tide.

Great confusion has arisen from attempts made to identify British Blennies with the *galerita* of Linnæus. The name of *galerita* was first employed by Rondelet to designate a Mediterranean Blenny, which has a fleshy *longitudinal* crest, that reaches from between the eyes to the occiput. This crest is confined to the male fish, and M. Valenciennes has ascertained that this species is the *B. pavo* of Risso, which name, to prevent further confusion, is adopted in the *Histoire des Poissons*. Artedi applied the term *galerita* to a Blenny which he characterizes as having a *transverse* cutaneous crest (Synon., p. 44, No. 3), but at the same time he refers erroneously to Rondelet, and Linnæus retained the expression of transverse as applied to the crest of the species he denominated *galerita*. In the *Histoire des Poissons*, the *galerita* of Artedi is recognised as a Madeira fish, and the appellation of *B. Artedi* bestowed on it. The species to which Professor Fleming gave the name of *Bl. Montagui*, has a transverse cutaneous crest or appendage, as described in the following quotation from Colonel Montagu's paper in the Wernerian Memoirs. The cut at the head of the article is from a drawing by Jonathan Couch, Esq.

"Body rather more slender than that of the Smooth

Blenny. Head much sloped; eyes high up, approximating, gilded; the upper lip furnished with a bony plate that projects at the angles of the mouth in a thin lamina that turns downwards, the ends of which are orange-coloured: on the top of the head, between the eyes, there is a transverse, fleshy, fimbriated membrane; the *fimbriæ* are of a purplish-brown colour, tipped with white; the nostrils are furnished with a minute bifid appendage, and behind the crest there are several minute, erect, filiform *appendiculæ*, ranged longitudinally between that and the dorsal fin: the lateral line is considerably curved near the head; the pectoral fins are large and ovate, reaching as far as the vent: the ventral fins consist of two unconnected rays: the dorsal fin extends from the head to the tail, and appears like two distinct fins, by reason of the slope to the thirteenth ray, which is not above half the length of the anterior ones, and the sudden elongation of the fourteenth ray: this fin is very high, and in one specimen there was an ovate black spot between the first and second ray, and another obscure one between the next rays; but this is not a constant character. The anal fin is equally high, and extends from the vent to the tail, the rays are bordered with black and tipped with white: caudal fin slightly rounded."

"The colour above is generally olive-green, spotted with pale blue, shaded to white; the belly is white, and the pectoral fins are spotted with orange.

"The numbers of the fin-rays are—

D. 30: P. 12: V. 2: A. 18: C. 14.

"Not fewer than eight or ten of this species have come under my inspection, the greater part of which did not exceed an inch and a half in length; but two at present before me measure nearly two inches and a half,

and differ in nothing but the spots on the dorsal fin. The crest is not capable of being erected,—at least no voluntary motion could be observed while the fish was examined alive in sea-water; but this appendage is invariably transverse, and generally conic or angular, and sometimes irregularly truncated, though always fimbriated."

This Blenny is occasionally taken, with others, among the rocks on the south coast of Devon, in the pools left by the retiring tide. Mr. Couch has obligingly sent me a specimen from Polperro; and in his recently-published Fauna of Cornwall mentions that it is not uncommon.

Mr. R. Q. Couch says in the Zoologist (1418) that this fish secretes itself within tide-mark in the crevices of rocks or under stones, where it remains till the return of the tide, frequently peeping out, but withdrawing on being observed. It spawns, he says, in August, and attaches its ova to the under face of the stone or rock beneath which it seeks shelter.

SHRIMPERS.

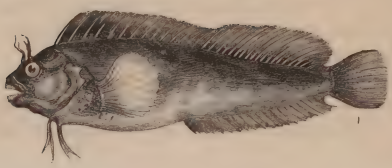
———whose feet tread ever the wet sands
And howling rocks along the wearing shore,
Roaming the confines of the endless sea!

THE OCELLATED BLENNY, OR BUTTERFLY FISH.

Blennius ocellaris, Brunnich. Bloch, pl. 167.
" " *Ocellated Blenny*, Montagu, M. Wern. S. ii. p. 443, pl. 22.
" " " " Flem. Brit. An. p. 206, pl. 119.
" " " " Jenyns, Brit. Vert. p. 378.
" " Cuv. et Valenc. Poiss. t. xl. p. 220.

The Ocellated Blenny was first described as a British fish by Colonel Montagu, who obtained three specimens by dredging on the south coast of Devon. Mr. W. Thompson, in a communication to the Zoologist (5608), dated February 1857, says, "This pretty fish was tolerably plentiful in Weymouth Bay until the severe winter three or four years back, when it totally disappeared; last week, however, I obtained two specimens." M. Gosse dredged a specimen in the same bay in July 1854. The example, from which the present description and figure were taken, was found among the rocks of the island of Portland.

The length near three inches; the head rounded and blunt: teeth uniserial, slender, elongated, rather un-



THE GATTORUGINOUS BLENNY.

Blennius gattorugine, Brunnich, p. 27, sp. 37.
,, ,, *Gattoruginous Bl.* Penn. Brit. Zool. iii, p. 278, pl. 89.
,, ,, ,, ,, Donov. Brit. Fish. pl. 86.
,, ,, ,, ,, Montagu, M. Wern. Soc. ii. 447.
,, ,, ,, ,, Flem. Brit. An. p. 206, sp. 120.
,, ,, ,, ,, Jenyns, Brit. Vert. p. 379.
,, ,, Cuv. et Valenc. t. xi. p. 200.

The Gattoruginous Blenny appears to be a rare fish on some parts of our sea-shore. Pennant first recorded it as British from a specimen taken on the Anglesey coast. Colonel Montagu obtained two in Devonshire, but considered it rare. Mr. Couch finds it frequently in Cornwall; and specimens of one inch and a half, two inches and a half, and five inches and a half, each, are now before me. For the first of these I am indebted to Mr. Couch, the second I obtained myself on our southern coast, and the largest example was given me by my friend Mr. Thomas Bell, who brought it from Poole Harbour. Mr. Gosse states it to be common in Weymouth Bay, and Mr. Thompson in his Natural History of Ireland mentions several instances of its capture on the coasts of that island. It is, he says, a

deep-water species, and is procured in lobster pots set in twelve or fourteen fathoms of water. Mr. Couch says that "on the Cornish coast it keeps near rocks where the water is four or five fathoms deep. It is called Tompot by the Cornish boys. At the end of May I have found it large with roe, the grains of which are, some of them of a mulberry, others of a lead colour; I have also seen numerous and minute young ones at the same season. In its stomach I have found various bivalve shells, parts of a Star-fish, and of the common jointed corallines and brown seaweed. Specimens occasionally measure eight or nine inches in length."—*Jon. Couch, Esq.* Mr. R. Q. Couch observes that its colour changes with that of the ground it inhabits.

Some differences exist in the descriptions and figures of this fish among several of the early, as well as of the more modern authors, and it is probable that a nearly-allied species may have been sometimes mistaken for the *gattorugine*. I have ventured to consider the Gattoruginous Blenny of Pennant, Montagu, and Donovan, as the same with that now described. A dried specimen of *gattorugine* from the Mediterranean, now before me, is the same as the English fish. M. Valenciennes, however, says that the *Gattorugin Blenny* of Pennant cannot be the species of Willughby (t. ii. 2, f. 2), unless the superciliary filament was mutilated in the specimen from which the drawing was made, as he thinks must have been the case, because Donovan's figure agrees better with the *gattorugine*.

The forehead slopes considerably: viewed in front, a groove appears between the eyes, which ends in a channel, passing downwards behind each eye, formed by the elevation of the border of the orbit; from the upper

and rather the posterior part of each eyelid arises a branched membrane; the eyelids extend considerably over the cornea all round; the nostrils are circular, situated in a depression, and above each there is a small fimbriated membrane, plainly observable with a lens: the lips are thin and loose, turning up or down to a considerable extent, and exposing the teeth; these are placed in a single row in each jaw, are long, slender, and semi-transparent, unequal in length in front, almost every other one having had a small piece apparently broken off; the teeth on the sides of the mouth are more uniform. The gill-cover ends in two angular points directed backwards, the free edge of the membrane being continued under the throat to the gill-cover on the other side.

The body is compressed, and deepest at the middle of the pectoral fins, from whence it tapers gradually to the end of the fleshy portion of the tail. The lateral line proceeds straight through the middle of the tail as far as the commencement of the anal fin, and then arches high over the pectorals.

The nape of the neck is elevated, and the dorsal fin commences on it directly over the preoperculum. The first dorsal ray is shorter than the second, the next ten are nearly equal in length, and about half the height of the body, the thirteenth ray is shorter, and the fourteenth is nearly one-fourth longer than the thirteenth, forming the notch in the outline of the fin; the remaining rays are nearer together than those that precede them, each portion of the fin occupying about the same space, with thirteen stiff rays in the first portion, and twenty flexible rays in the second; the membrane beyond the last ray extends to the base of the upper caudal fin-ray.

The pectoral fins are broad and rounded, the central rays being the longest, and equal to the length of the

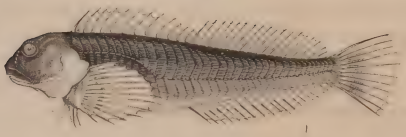
head. The ventral fins are slender. The anal fin, which is half as long as the head and body of the fish, commences rather before the depression in the dorsal fin, and immediately behind the vent: the points of its rays project, and its last ray is joined by the membrane to the body of the fish, but does not quite reach the tail-fin. The tail itself is slightly rounded, the rays about equal in length to those of the pectoral fin.

D. 33: P. 11: V. 2: A. 23: C. 11.

The prevailing colour of this specimen is a dark red or purplish-brown, the lower part of the head, belly, and hinder portion of the body being pale brown, and all the fins dark brown. The smaller examples referred to differ only in colour, being barred transversely, and clouded with a reddish-brown over a light-brown surface; the membranes of the fins are also of a much lighter brown.

The name of *gatturogine* is professedly derived from the vulgar appellation of the fish at Venice, but opinions differ as to whether it has reference to the thickness of the throat, or is meant for "rusty cat."

RIVER-FISHING.



THE SHANNY, OR THE SHAN.

CLEIRACH GWYMMON, *Wales.*—SHAW and PARROT-FISH, *Ireland.*

Blennius pholis, Smooth Shan, LINN. JENYNS, Brit. Vert. 382.
,, ,, ,, *Blenny,* PENN. Brit. Zool. vol. iii. p. 280, pl. 40.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 79.
,, ,, ,, ,, THOMPS. N. H. of Irel. iii. p. 110.
Pholis levis, ,, *Shan,* FLEM. Brit. An. p. 207, sp. 123.
,, ,, CUV. et VALENC. Poiss. t. xi. p. 269.

THE SHANNY is by no means uncommon on the rocky parts of our coast, and is easily distinguished among the Blennies by the want of any appendages on the head; the outline of the dorsal fin is also notched. Dr. Fleming separated the Blennies which have no filaments or tags of skin on the head, from the rest of the genus, naming the group *Pholis*. The term Smooth Blenny has not been continued here, as this name conveys no specific distinction, all the British Blennies being smooth.

"Destitute of a swimming-bladder, this fish," says Mr. Couch, "is confined to the bottom, where it takes up its residence on a rock or stone, from which it rarely wanders far, and beneath which it seeks shelter from ravenous fishes and birds; yet cormorants, with their

long and sharp beaks, drag multitudes from these retreats, and devour them. When the tide is receding, many of these fishes hide beneath the stones or in pools, but the larger individuals quit the water, and by the aid of the pectoral fins creep into convenient holes, rarely more than one in each, and there, with the head outward, they wait for a few hours, until the return of the water restores them to liberty. If discovered or alarmed in these chambers, they retire by a backward motion to the bottom of the cavity. These circumstances show that the Shanny is retentive of life; in confirmation of which I have known it continue lively after a confinement of thirty hours in a dry box, notwithstanding which it soon expires in fresh water."

For the following account of the habits of this fish, I am indebted to Francis Ross, Esq., of Broadway House, Topsham, Devonshire, communicated by a letter dated June 5, 1847. "Having placed one of these little fishes in a globe of sea-water, after some hours it became very restless and floundered about, when it occurred to me, that on a former occasion I had observed a fish of the same species to be in the habit of mounting a stone at regular periods. I therefore placed a stone in the globe of water, and immediately the Blenny leaped on it, completely out of water. The ebb-tide was at this time running out strong, and the fish remained quiet on the stone till the return of high water, when it slid off. I continued to observe the movements of the captive for some days, and found that it always passed the hours of ebbing tide on the top of the stone." M. H. Greatwood (Zool. 2029), referring to Mr. Ross' observations, says that the Blenny changes colour with its situation, that it is of a pale yellowish-brown in the water, but after inhaling atmospheric air freely for some time, its

hue changes to a deeper brown, and a series of white spots on the lateral line become conspicuous.

Mr. Guyon, in the same work (3514), observes that the appetite of the Shanny is most accommodating. One, that he kept in sea-water about half a year, devoured spiders, scolopendræ, caterpillars and mollusks, every movable creature being acceptable to it, nor did it disdain a bit of roast beef, mutton, fowl, or chop. Its colour was very variable, the dark tints being always assumed when the water was changed, or when the fish was alarmed. The eyes moved very freely and independently of each other. Mr. R. Q. Couch (Zool., 798 and 1418) informs us that when the Shanny spawns, it selects cavities in rocks a little above low-water mark, and deposits its roe on the roof and sides. The eggs are semicircular, with a highly-polished surface, about a tenth of an inch in diameter, and of a beautiful bright amber colour. Mr. Couch proved them to be the ova of the Shanny by hatching them. The energy of the Shanny in escaping over moist gravel is, Mr. Thompson says, very surprising.

Furnished with long and firm incisor teeth, the Shanny is able to separate from the rocks, muscles, limpets, and other shelly mollusks, on which to feed. Its spawn is deposited in summer, and soon comes to life.

The head is rounded over the eyes, descending from thence rapidly to the nose; between the eyes there is a deep groove; the irides are scarlet, and there are no appendages either to the orbit or eyelids; the inferior aperture of the nostrils has a small fimbriated membrane above it with five rays, and the upper aperture, narrow and oblong, is in front of the edge of the orbit; the mouth is small and angular, the lips large and broad, the posterior angle on each side free; the teeth are

small, in a single row of about twenty in each jaw, with a canine tooth at each extremity of the row; the cheeks are tumid and the gill-apertures large, the free edge of the membrane extending across the throat. The fin formula is—

D. 31: P. 13: V. 2: A. 19: C. 11.

The dorsal fin commences directly over the union of the operculum with the body, the first portion consisting of twelve rays, the last of which is the shortest; the thirteenth is as long again as the twelfth, eighteen others succeed, nearly of equal height, and the last of all is united to the tail by a continuation of the membrane. The ventrals consisting of two rays, originate before the pectorals, and immediately behind the edge of the gill-cover: the pectoral fins are large and rounded, the middle and longest rays reaching as far as the vent: the anal fin commences immediately behind the vent, and under the notch in the dorsal fin; its last ray is attached to the tail-fin; the tips of all the anal rays extend beyond the membrane: the caudal fin is rounded; the lateral line proceeds straight forwards, for two-thirds of its length, and then curves over the pectoral fin to the upper edge of the operculum. "It has justly been observed, that this species is extremely variable in colour; out of twenty or more examined at the same time, not two were to be found alike; some are prettily mottled with reddish brown, others quite plain, and one variety is of a uniform dusky colour, even on the under parts."

"This species of Blenny is remarkably tenacious of life, and will live out of water for many days in a damp place, or put in fresh grass or moss moistened with water; and probably, with a little attention, might be kept alive in this way for many weeks. If put into fresh water,

it swims, and does not appear to feel any inconvenience, but does not long survive the change."—*Montagu's MS.*

It rarely exceeds five inches in length.

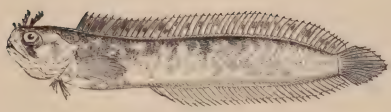
According to Mr. Thompson this fish is found on the south, the west, and north-east coasts of Ireland: Dr. George Johnston finds it to be common in Berwick Bay; and Dr. Parnell says it is abundant in the Frith of Forth.

There dwells a fisher; if you view his boat,
With Bed and Barrel—'t is his House afloat!
Look at his House, where ropes, nets, blocks abound,
Tar, pitch and oakum—'t is his Boat aground!

CRABBE.

Hic steterat nautis olim venerabile lignum.

ÆN. xii. 754.



YARRELL'S BLENNY.

Blennius	*Yarrellii,*	Cuv. et Valenc. Poiss. t. xi. p. 218.		
,,	*galerita,*	Ström. Nillson, Ichth. Scand. 102.		
,,	,,	*Crested Blenny,* Penn. Brit. Zool. iii. p. 276, pl. 39.		
,,	,,	,,	,,	Flem. Brit. An. p. 207, sp. 122.
,,	*palmicornis,*	,,	,,	Yarrell, Brit. Fish. 1st Ed.
,,	,,	,,	,,	Jenyns, Brit. Vert. p. 380.

The Blenny figured above appears by the observations of M. Valenciennes in the *Histoire des Poissons* to be neither the *B. palmicornis* of Cuvier, nor the true *B. galerita* of Rondelet; and to obviate the inconvenience which has arisen from the various synonyms with which it has been hitherto associated, M. Valenciennes has done me the honour to propose that in future it should be called *Blennius Yarrellii.*

I was indebted to the kindness of Dr. George Johnston of Berwick-upon-Tweed, for the only specimen of this fish I had seen previous to the publication of the first edition of British Fishes. It was valuable, in affording me an opportunity of giving a detailed description of the species, which, from the evidence to be quoted, I am induced to believe to have been first confounded by Ström, and

afterwards by Linnæus, who followed Artedi, with the true *galerita* of Rondelet, the *alauda cristata sive galerita*.

Since the publication of the first edition of this work, I have received from T. P. Teale, Esq., of Leeds, a detailed description of another specimen of this Blenny, taken at Redcar in Yorkshire, in September 1835: it proved to be a very fine specimen, measuring six inches and three-quarters in length. Mr. R. Q. Couch, in the Zoologist for 1846, says, that it has been frequently taken in South Cornwall. Mr. Thompson got specimens from a lobster-pot, set near the Isle of Portland; it inhabits also the Moray Frith, and has been found among the Orkney Islands. Mr. C. W. Peach has taken upwards of ten examples of the species in Cornwall, and at Wick and Peterhead in the north of Scotland. In Ireland it has been procured on the coasts of Wicklow and Down.

In the account of Montagu's Blenny, the misapplication of Rondelet's specific epithet of *galerita* has been referred to, and it may be added here that Linnæus, in the tenth edition of his *Syst. Nat.* 1758, quotes only Artedi for his *Blennius galerita*, continuing the character of the transverse crest. In 1762, Ström published his account of the Fishes of the extreme North-western coast of Norway, wherein he describes a Blenny, which he considers to be the *galerita* of Artedi, and gives an enumeration of its fin-rays. Linnæus, in his twelfth edition, 1766, quotes both Artedi and Ström for his *Blennius galerita*, adding the number of fin-rays from Ström, thus fusing two distinct species under one name. Pennant, finding on our shore a specimen of the northern Blenny of Ström, referred it to the *galerita* of Linnæus, and Gmelin followed Linnæus and Pennant, in repeating the misappropriation of the term *galerita*.

The error of Gmelin was first pointed out by Schneider

in the posthumous edition of Bloch, (page 169, note,) with a reference also to Linnæus and Ström. Cuvier considers the *galerita* of Rondelet to be the same with the *B. pavo* of Risso, a fish having only thirty-six rays in the dorsal fin, and but twenty-four rays in the anal fin.

A comparison of the figure at the head of this article with that of the Crested Blenny of the British Zoology, will leave but little or no doubt that they are intended to represent the same species. Dr. Fleming, in his History of British Animals, has described, under the term *B. galerita*, a Blenny, obtained in Loch Broome, which differs but little from the specimen taken by Dr. Johnston in Berwick Bay; and Professor Nilsson, in his Prodromus of the Fish of Scandinavia, has also enumerated our species under the name of *B. galerita.**

The description which follows, taken from the fish caught in Berwick Bay, will be found to contain most if not all the characters embraced in the descriptions of Pennant, Fleming, and Nilsson.

The whole length of the specimen was three inches and three-eighths; the depth of the body, seven-sixteenths of an inch, or including the dorsal and anal fins, three-quarters of an inch. The body is much compressed; the head more oval, the profile rounded; the outline of the mouth, when viewed from above, forms a half circle; and viewed laterally the angle of the mouth is depressed; in front the mouth appears wide; the lips are capable of

* As this useful little book may not be in the possession of many, I here add the passage referred to:—"Bl. tentaculis duobus supraciliaribus ramosis; radiis pinnæ ventralis tribus; capite superius barbato; corpore rutilo, maculis 10—12 dilutioribus rotundis ad latera dorsi. Obs. Alia specimina furviora sunt et maculis dorsi dilutioribus carent. In aliis exemplis spinæ 3—4, dorsales anteriores ceteres sunt longiores et appendicibus crassis ramosis ornatæ; in aliis hæ spinæ breviores sunt et appendicibus, simplicibus, gracilibus terminantur."

extensive motion; and the teeth are smaller and shorter than those of any other British Blenny.

At the superior anterior margin of the eye on each side there is a small fimbriated appendage, which is connected with that on the opposite side of the head by a transverse fold of skin that crosses the prominent forehead; behind these two small appendages are two other tentacula, one on each side, about twice the length of the anterior pair, and also fimbriated. On the nape of the neck, and for some distance towards the commencement of the dorsal fin, the skin is smooth, with the exception of various small papillæ, which were noticed by Dr. Fleming; the eyes are lateral, and large for the size of the head, but not so large by comparison as those of the other Blennies.

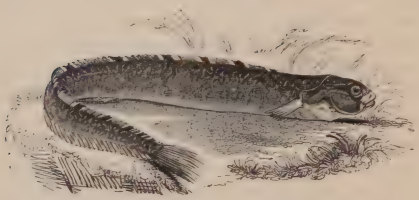
The dorsal fin commences three-eighths of an inch behind the last pair of tentacula; it is uniform in height throughout, and reaches to the tail-fin; the first ray is a little shorter than the second one, and the first three rays have membranous filaments, as described by Dr. Fleming. The membrane connecting the first four rays is darker in colour than the other parts of the fin; the points of all the rays project beyond the edge of the connecting membrane, and the last ray is united to the tail by membrane; all the rays are simple.

The ventral fins are only three-sixteenths of an inch in length, are placed rather before the pectorals, and are supported by three rays, as ascertained by carefully dissecting off the investing membrane. The pectoral fins are rounded when spread, pointed when closed, the middle rays being the longest, and reaching over two-thirds of the space between the edge of the operculum and the commencement of the anal fin. The vent is placed immediately in advance of the anal fin, which in

length is equal to half the length of the whole fish; the first anal fin-ray is shorter than the second, the others are as long as those of the dorsal fin, but their ends project further, the connecting membrane not being so deep. The caudal is rounded, or rather slightly lanceolate, the central rays being the longest. The lateral line is straight. The membrane connecting both opercula is continuous under the throat, and there are many mucous pores in the supra scapular region.

The general colour of the body and fins is a pale brown, mottled on the sides with darker brown; the head, the anterior part of the body, the ventral and pectoral fins being darker than the other parts.

There was considerable variety in the number and development of the cutaneous appendages in the specimens obtained by Mr. Peach, the differences depending probably on age, sex, and season. The most constant and most widely branched of these appendages is the pair between the eyes. The shorter pair on the forehead is occasionally absent, as are also those on the three front dorsal spines, which are sometimes when present mere sessile tufts, at other times they are stilted up above the point of the ray, and are forked and fringed. Mr. Couch noticed that power of independent movement in the eyes which is so remarkable in many members of the Goby and Blenny families. He frequently observed this Blenny to turn one of its eyes upwards, and the other downwards, and that it could roll its eyes in any direction, either independently or in unison. The pear-shaped mucigenous pores on the sub-orbitar chain were also seen by him to contract and expand with each respiratory movement of the gills.



THE SPOTTED GUNNEL, OR BUTTERFISH.

STANE-CHECKER, *Scotland.*—SWORDICK, SWAAR-FISH, *Orkney.*—TISTEFISK, *Scandinavia.*

Murænoides guttata, LACEPEDE.
Blennius gunnellus, LINNÆUS. BLOCH, pl. 71, f. 1.
" " *Spotted Blenny*, PENN. Brit. Zool. vol. iii. p. 282, pl. 60.
" " " " DONOV. Brit. Fish. pl. 27.
Gunnellus vulgaris, CUV. et VALENC. Poiss. t. xi. p. 419.

MURÆNOIDES. *Generic Characters.*—Compressed sword-shaped scaly fishes, with a small head and minute jugular ventrals, sometimes reduced to a solitary spinous point; a long low dorsal sustained by simple unarticulated rays, and an anal about half as long united to the base of the rounded caudal. Teeth on the jaws pointed, with a villiform band on the premaxillaries, and some microscopical ones on the vomer, tongue, and palate. Intestinal canal simple, straight; no air-bladder; no genital papilla, and no barbels nor cutaneous processes on the head.

THE SPOTTED GUNNEL, or Butterfish, as it is frequently called, from the consistence and quantity of mucous secretion with which its sides are covered, is sufficiently distinguished from the true Blennies by its low dorsal fin; and by its elongated, slender, and compressed body, it has obtained in the Orkneys, and in some of the countries of the North of Europe, the names of Swordick and Svardfisk (*Norway*) from its re-

semblance in shape to the blade of a sword. Its thinness has also acquired for it the epithet of Gunnel or Gunwale in this country, such being the name of the thin deal forming the upper streak of a boat, which the fish is supposed to be like.

It is a common small fish on our sea-shores, where it is often left by the tide, on sandy flats or under stones or seaweed. In such situations it appears to suffer little or no inconvenience for several hours, though moistened, externally only, by contact with the wet seaweed or damp rocks. In a pool of water it is observed to swim rapidly, and is difficult to catch, shifting its situation with great quickness, and creeping into very small apertures; it is not easy to retain it in hand, from its slipperiness caused by a copious slimy secretion which its skin emits. Its food is marine insects, the spawn of other fishes and their fry. It occurs generally on the rocky parts of the southern coast, sometimes under stones in soft mud, and is found in Cornwall, Devonshire, and all along the east coast, being very plentiful on the Lincolnshire flats. It has been taken in Berwick Bay, the Frith of Forth, in Orkney, and Zetland. Linnæus includes this species in his *Fauna Suecica*, and other Northern naturalists have found it on the coast of Norway, as well as on various parts of the shores of the Baltic.

The flesh of this fish is seldom if ever made use of in this country, except as bait for sea-lines. It is said to attain the length of ten inches: the more frequent size on our shores is from five to seven inches.

The length of the head is equal to the depth of the body, and forms an eighth part of the whole length, caudal fin excluded. The head is small; and the line of the mouth descends obliquely to the corner,

the mandible being rather the longer of the two jaws; the teeth are small, short, pointed, and sharp, and each tooth is separated from the next by a space equal to the breadth of the tooth itself; behind the exterior row in front of the upper jaw there is a villiform band; the eyes are lateral, moderate in size, and the irides are dark blue; the cheeks are tumid, from the size of the muscles, which enable it to bite hard. The membrane connecting the opercula is continuous under the throat, and a row of mucous pores descends from the nape to the upper edge of each operculum.

The number of fin-rays is—

D. 78: P. 11: V. 1+1: A. 2+43: C. 15.

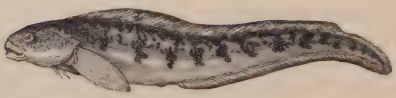
In long fins containing numerous rays, the number, it should be remarked, is at all times liable to variation, and it is not, it may be added, always uniform even in species with short fins.

The dorsal fin commences a little behind the origin of the pectoral fin, and extends the whole length of the back, to the base of the caudal: both the rays and the membranes of this fin are short, or but little elevated, but all the rays project their sharp points beyond the edge of the membrane. The pectoral fin, small and oval in shape, arises immediately behind the free edge of the operculum; the ventral fins are very small, near each other, on the under part of the throat, and appear each like a single sharp spine projecting through a small fleshy tubercle partly supported by one soft ray. The vent is situated under the thirty-fourth ray of the dorsal fin, at about an equal distance between each extremity of the fish; the anal fin commences immediately behind the vent, and extends to the tail, to which it is united; its rays are longer than those of the dorsal fin; the first two are spinous, but the others, which are branched and ar-

ticulated, project further beyond the edge of the membranes. The tail-fin is moderate in size, and slightly rounded. The lateral line proceeds straight forwards from the centre of the tail-fin, keeping rather below the middle height of the fish.

The general colour of the body is a mixture of purplish-brown and yellowish-brown, sometimes dappled, occasionally assuming a waved or banded appearance. Along the base of the dorsal fin are a series of from nine to twelve conspicuous dark spots with a narrow but well-defined white stripe before and behind, and sometimes encircling each of them: these dark spots are sometimes situated on the dorsal fin, in some specimens they are on the back of the fish, below the base of the dorsal fin, and occasionally they occupy an intermediate situation, being partly on the back, and partly on the fin; the under surface of the head, the pectoral fins, and belly to the vent, are of a more uniform pale brown; from the eye a dark brown stripe descends, behind the angle of the mouth, to the mandible. The spots described as dark along the back are occasionally not very conspicuous, and specimens sometimes occur in which they are entirely wanting.

A specimen of a Spotted Gunnel from America, for which I am indebted to the kindness of Mr. Audubon, proves on comparison to be in every respect so similar to the British Gunnel, that there is little doubt of its being the same species. The American specimen measures seven and a quarter inches; the largest British example I have measures only five and three-quarters, but some are occasionally found of greater length. This species was first described and figured by Willughby, page 115, tab. G. 3, fig. 3, from a specimen obtained at St. Ives.



THE VIVIPAROUS BLENNY.

EELPOUT, GUFFER, AND GREENBONE, *Scotland.*

Zoarcæus viviparus, Cuv. et Valenc. Poiss. t. xi. p. 454.
Blennius ,, Bloch, pl. 72. Penn. Br. Zool. iii. p. 283, pl. 61.
,, ,, Donov. Brit. Fish. pl. 34.
Zoarces ,, *Viviparus Blenny*, Jenyns, Brit. Vert. p. 384.

Zoarcæus. *Generic Characters.*—Elongated subfusiform fishes clothed with very muciparous skin, in whose thickness minute delicate scales are imbedded; ventrals jugular, of two or three rays; dorsal occupying the whole length of the back, sustained in front by jointed rays, which are followed by spinous ones, and these again by jointed ones, that unite with the small caudal. Anal also continuous with the caudal. Jugular ventrals of three rays. Branchiostegals six. Teeth on the jaws conical, and in several rows anteriorly but uniserial towards the corners of the mouth: palate toothless. A tubercle at the vent: viviparous fish. No air-bladder.

The Viviparous Blenny differs from the other British Blennies in the circumstance to which its name refers—that of bringing forth its young alive, which seem perfectly able to provide for themselves from the moment they are excluded. Mr. Low, in his *Fauna Orcadensis*, says, when he first observed this, he put a number of the small fishes into a tumbler-glass of sea-water, and kept them alive for many days, changing the water every tide. They grew a good deal bigger, and continued very lively, till in a hot day, forgetting to refresh them with clean water, they died to the last fish.

While they were very young and transparent, they made excellent objects for viewing the circulation of the blood in the microscope. The females appear to produce their young more or less grown according to their own size.

Mr. Neill says, "though not a delicate morsel, this fish is often brought to the Edinburgh market." In the month of February 1807, this gentleman saw a female fifteen inches long in the fish-market, from which several dozens of young escaped alive: these fry were from four to five inches long. In a female of seven inches, obtained by myself on the Kentish coast, full of young, these, when excluded, were only one inch and a half long; but such was the perfection of the internal organization of this female, that after the specimen had been kept for months in diluted spirit of wine, on making slight pressure upon the abdomen, the young were excluded one after another, and invariably with the head first. The arrangement of the perfectly-formed young in the fœtal sac of the gravid female is very remarkable.

Montagu considered the Viviparous Blenny to be a scarce fish in Devonshire, as he obtained only a single specimen in several years; but Mr. Charles Barron says, that it is common all along the Hampshire coast, wherever there are large stones or rocks in which it can find hiding-places. As a species its earliest describer was Schonevelde, whose name and discoveries have been previously referred to. Sir Robert Sibbald first noticed it in Scotland. It occurs on the Norfolk and Yorkshire coasts, in Berwick Bay, in the Forth, and on the coasts of Norway and Sweden, where hiding itself, as it does on our own shore, under sea-weed, which is called tâng, it has acquired the name of Tânglake.

The whole length of the specimen here described was

seven inches; the length of the head, as compared with the entire length of the fish, is as one to six; the upper jaw is the longest; the teeth are short, conical, and sharp, with a second row in the front only; the lips are fleshy; the eyes small, and lateral, the irides blue; the nostrils are situated half-way between the inferior edge of the upper lip and the edge of the orbit, and each nostril is surmounted by a small cutaneous tag; numerous mucous pores exist above the lips, the cheeks are flat; the free membranous edge of the operculum ends in an angle directed backwards: the pectoral fins are large, broad, and rounded, nearly as long as the head, and reach half-way from the operculum to the commencement of the anal fin; the free edge of the gill membrane passes across the throat as in the Blennies: the ventrals are small, narrow, and pointed, about one-third the length of the pectorals, and placed in advance of them; the investing membrane being dissected off, exposes three branched rays.

The dorsal fin commences at the nape, over the angle of the operculum; the membrane investing and connecting its rays is too dense to admit of their number being ascertained with certainty or facility. The edge of the dorsal fin is straight till within a short distance of the tail, where a slope or emargination takes place. The form of the tail is lanceolate, but not distinguished by any separation from the dorsal or anal fin, which runs forward four inches.

The numbers of the fin-rays are in the dorsal, anal, and caudal fin, as united,

About 200 : P. 18 : V. 3.

The general form of the body is lanceolate, tapering gradually both in thickness as well as depth from the shoulder to the end of the tail. The colour is pale brown; the dorsal fin, upper surface and sides are mottled, and

banded with darker brown; the under part of the head, pectoral fins, belly, and anal fin exhibit an uniform pale brown tint. The lateral line traverses the centre of the body, and is slightly elevated only as it approaches the anterior third of the fish. The surface of the body appears, under a lens, to be studded with circular depressions, under each of which a minute scale is buried.

When boiled the bones of this fish are green, and hence its name of Greenbone.

Lubrica nascentes implent conchylia lunæ,
Sed non omne mare est generosæ fertile testæ.
HORACE, *Sat.* ii. 4.

Ostreis et conchyliis omnibus contigit, ut cùm lunâ pariter crescant, pariterque decrescant.—CICERO, *de Div.*

THE WOLF-FISH.

SEA-WOLF, SEA-CAT, *Scotland.*—SWINE-FISH, *Orkney.*—HAFKATT, *Sweden.*—STEINBITR, *Iceland.*

Anarrhichas lupus, Linnæus. Bloch, pl. 74.
,, ,, Cuv. et Valenc. Poiss. t. xi. p. 473.
,, ,, *Wolf-fish*, Penn. Brit. Zool. vol. iii. p. 201, pl. 27.
,, ,, *Striped Sea-wolf*, Donov. Brit. Fish. pl. 24.
Lupus marinus, Cat-fish, Sibbald, Scot. Ill. iii. 25.

Anarrhichas. *Generic Characters.*—Apodal blennioid fishes, with strong conical teeth on the premaxillaries and front of the mandible, and rows of bony tubercles on the limbs of the mandible, on the vomer and palatines, each tubercle being crowned with a tooth. An even dorsal occupies the whole back, and is supported by simple jointless flexible rays: a shorter but otherwise similar anal is connected to the base of the rounded caudal by membrane. Skin soft, mucoid, with small scales buried under the epidermis. Branchiostegals six. A short fleshy stomach with a short cæcal projection under the pylorus: no pancreatic cæca; no air-bladder.

The Wolf-fish of the British coast is almost exclusively a northern fish, and has seldom been observed on our southern shore. It is taken off the coasts of Norfolk and Yorkshire, in Berwick Bay, in the Frith of Forth, and among the Orkneys, occasionally also on the eastern coast of Ireland; and it is well-known on the northern shores of Europe, and in Greenland and Iceland.

The appearance of this fish is not prepossessing. Independently of a ferocious-looking cat-like head, with an

exceedingly thick, coarse skin, covered with slime, it possesses most formidable teeth, and neither wants the will nor the power to attack others or defend itself. It is occasionally caught with a baited hook, and at times decoyed into the meshes of a net by the temptation of feasting on the fishes already entangled; but fights desperately, even when out of its own element, inflicting severe wounds if not cautiously handled. The nets also are frequently torn by its powerful struggles; and a spirit of retaliation for the labour thereby occasioned, or for personal injury inflicted by it, brings a speedy death to the unfortunate fish. Handspikes and spars of wood are articles always at hand in fishing-boats, and the savage Sea-cat is speedily rendered incapable of doing further harm by heavy well-aimed blows upon the head. It is capable of living long out of water.

According to Mr. Neill, specimens of small size, about two feet in length, are frequently brought to the Edinburgh market; and people who are able to overcome the prejudice excited by the aspect of the fish find it good food. Mr. Hoy and Mr. Low have borne their testimony to the excellence of its flesh, and Mr. Donovan states that it is delicious. It may be observed here, that this is the general character of the flesh of those fishes that feed on crustaceous animals. It is eaten by the Norwegians and Greenlanders, as well as by most of the inhabitants of the northern parts of Europe, the head and skin being first taken off. The skin is converted into very durable bags and pockets. Sibbald says that its flesh has an excellent savour; and the Swedish fishermen are said to relish it greatly, especially the liver, notwithstanding the disagreeable smell of the fish. No special fishery is established for its capture, but it is taken fortuitously in nets or baskets, and by hooks baited for Cod-fish.

The food of the Wolf-fish consists of crustaceous and testaceous animals, which its powerful jaws and rounded molar teeth enable it to break down sufficiently for its purpose. The vignette at the end of this article, being a representation of the dentiferous jaw-bones of this fish, shows the formidable nature of the weapons with which it is furnished; while its German and Danish names have reference to a supposed power of crushing even stones in its mouth. It swims rapidly, with a lateral undulating motion; and has acquired the name of Sea-wolf from its ferocity. It has no swim-bladder, and keeps habitually to the bottom among large stones and projecting rocks, often lying long and quietly in such places, with its body bent. In the Orkneys it is called Swine-fish, from a particular motion of the nose. The scientific name of *Anarrhichas* signifies the climber, and is a misnomer, having originated in a mistake as to the habits of the fish. It approaches the shore to deposit its spawn in the months of May or June; and the young, of a green colour, are occasionally found among sea-weed.

The numbers of the fin-rays are—

D. 74 : P. 20 : A. 46 : C. 16.

The head is slightly flattened on the top; the nose rounded and blunt, the nostrils small; the eyes near the end of the nose, the irides pale yellow; the mouth large and the lips fleshy; the form and arrangement of the teeth are shown in the vignette; mucous pores are abundant about the eye, the gill-cover, and lower jaw on each side. Body elongated, compressed towards the tail; the dorsal fin extends from the nape of the neck almost to the caudal, but is not joined to it; the pectoral fins are broad and rather long; the ventral fins wanting: the anal fin borders the posterior half of the body, and is connected by a low membrane to the rounded tail-fin.

The upper part of the head, the sides, back, and fins, are of a brownish-grey; the body is crossed by vertical bands, and varied with spots of darker brown, some of which extend over portions of the dorsal fin; the belly and under surface generally are white.

The gullet is wide and the pylorus is near the bottom of the bag-like stomach. There are no cæca. The two ovaria end in a common wide efferent duct.

This fish attains the length of six or seven feet, and in the colder and more extreme northern seas is said to become still larger. Bloch's figure of the Wolf-fish errs in the teeth, those he has given to it being the teeth of a *Chrysophrys*.

JAWS OF A WOLF-FISH.

Quid dignum tanto feret hoc promissor hiatu.
HOR. *de Art. Poet.*

THE ANGLER, FISHING-FROG, OR FROG-FISH.

SEA DEVIL, WIDE GAB, *Scotland.*—MORLYFFANT, *Wales.*—FRIAR, MOLLY GOWAN, BRIARBOT, KILMADDY, *Ireland.*

Lophius piscatorius, LINNÆUS. BLOCH, pt. iii. pl. 87.
,, ,, CUV. et VALENC. Poiss. t. xii. p. 344.
,, ,, *Common Angler,* PENN. Brit. Zool. vol. iii. p. 159, pl. 21.
,, ,, ,, ,, DONOV. Brit. Fish. pl. 101.

LOPHIIDÆ. *Family Characters.*—Skeleton fibrous, rarely much indurated. Scales almost always wanting, but replaced in some genera by osseous tubercles, or spines with swollen bases. Fore-arm supporting the pectoral fin, prolonged. Gill-openings restricted to a slit or round hole behind the pectoral and not extending forward under the edges of the gill-flaps. No sub-orbitar bones. (*Pectorales pédiculées,* CUV. *Armflosser,* Germany.)

LOPHIUS. *Generic Characters.*—Head enormous, broad, depressed, spiniferous. Nostrils cumpanulate, and stilted. Mouth very wide: teeth movable, and slender on the jaws, palatines, front of the vomer and pharyngeals, but the tongue is unarmed. Branchiostegals six, the membrane bag-like; branchial arches three; no pseudobranchiæ. Dorsals two, the tall anterior rays of the first detached to the head, filamentous and articulated by a ring to their interneural bones. Stomach large and muscular; intestine short; two pancreatic cæca. No air-bladder.

THE ANGLER, as this fish is called for reasons that will be given hereafter, belongs to a small and singular group of fishes, which Cuvier has designated *Pectorales Pédiculées,* from the peculiar conformation of the pectoral

fins, by which some of the species can creep on land almost like little quadrupeds. The ventral fins, palmate in form, are placed very far forward on the body: and the pectorals, from their position, perform the office of hinder feet.

This fish, which is not uncommon in the seas of Europe, and was in consequence called *Lophius Europæus* by Shaw, has also been called Frog and Frogfish from the earliest time, because of its resemblance to a frog in the tadpole state. Its habits appeared to the fishermen of former days so exact a representation of the art they themselves practised, that they by common consent called it the Fisher. Aristotle terms it a sort of Frog, which he says is also called a Fisher; and he adds that this fish owes its name to the tact and industry that it exercises to procure food. Belon calls it *Pescheteau* and *Bauldroy*.

The Angler is not rare on any part of the coasts of Great Britain and Ireland, and is particularly common in the Solent and in the harbours of Portsmouth and Southampton. In the Bristol Channel it is a favourite with the fishermen because it devours their great enemy the Dogfish.—(*Zoologist*, 3333.)

In its appetite this fish is most voracious; and as it is not a rapid swimmer, it is supposed to be obliged to have recourse to art in order to satisfy its appetite. Upon the head, as will be seen in the figure, are two slender elongated appendages, or detached dorsal rays, the first of them broad and flattened towards the end, and having there a shining silvery appearance. These elongated filaments are curiously articulated at the base with the upper surface of the head. They are moved freely, the first ray more especially, by numerous muscles, amounting, according to M. Bailly, to twenty-two. The figure on the left side of the vignette on the following page, shows

the articulations of these two elongated rays, by which freedom of movement is secured. The first joint resembles two links of a chain, and allows an almost rotatory motion; the second appears, except in as far as flexibility may assist it, to be only capable of being brought forward or backward.

These elongated rays are formed of bone covered by the common skin; and as the soft parts are abundantly supplied with nerves, they may also serve the Angler as delicate organs of touch. The uses to which they are said to be applied are singular. While couching close to the bottom, the fish, by the action of its ventral and pectoral fins, stirs up the sand or mud: hidden in the obscurity thus produced, it elevates these appendages, moves them in various directions by way of attraction as a bait,

and the small fishes approaching either to examine or to seize them, immediately become the prey of the Fisher.*

* The figure on the right hand of the vignette, copied from the Transactions of the Royal Society, represents the heart of the Angler. The lower portion is the auricle, in which the large veins unite. The auricle opens into the side of the middle portion, which is the ventricle. The upper part is the expanded base of the branchial artery, forming the *bulbus arteriosus*. Above the bulb the branchial artery divides to form three branches, and further division takes place before passing to the branchial arches.

Numerous are the writers who have borne their testimony to this habit, and some have extolled it as raising the intellectual character of this fish beyond that of most of its class. Half the animal world subsist by destroying each other, some by open violence, others by stratagem; and in the Angler this contrivance, though singular, is not more wonderful than that of the spiders, who spin and repair their widely-spread webs to catch the insects upon which they subsist.

The Angler has been known to measure five feet in length, but the most common size is about three feet. Mr. Couch says, "It makes but little difference what the prey is, either in respect of size or quality. A fisherman had hooked a Cod-fish, and while drawing it up he felt an additional weight on his line: this proved to be an Angler of large size, which he compelled to quit its hold by a heavy blow on its head, leaving its prey still attached to the hook. In another instance, an Angler seized a Conger Eel that had taken the hook; but after the latter had been engulphed in the enormous jaws, it struggled through the gill-aperture of the Angler, and in that situation both were drawn up together. I have been told of its swallowing the large ball of cork employed as a buoy to a bulter, or deep-sea line; and the fact this implies of its mounting to the surface is further confirmed by the evidence of sailors and fishermen, who have seen it floating, and taken it with a line at mid-water. These fishes sometimes abound; and a fisherman who informed me of the circumstance, found seven of them at one time on the deck of a trawl-boat: on expressing his surprize at the number, he was told that it was not uncommon to take a dozen at once."—*Couch's MS.*

"When this fish is taken in a net, its captivity does not destroy its rapacious appetite, but it generally devours

some of its fellow-prisoners, which have been occasionally taken from its stomach alive, especially Flounders. It is not so much sought after for its own flesh, as for the fish generally to be found in its stomach: thus, though the fishermen reject the fish itself, they keep those that it has collected."

"A female examined measured three feet three inches; the breadth across the body at the pectoral fins was fifteen inches. Within the teeth, on the lower jaw, there is a loose skin of a brown colour, forming a sort of bag, which probably assists in preventing the escape of its smaller prey. A male examined was three feet five inches long. When this fish was suspended by the head, the contents of its stomach were readily seen, and I perceived several Cuttle-fish. The sexes are distinctly marked by external appendages, as in some species of *Raia*."—*Montagu's MS.*

The numbers of the fin-rays are—

D. III. 12: P. 20: V. 5: A. 8: C. 8.

The head is wide and depressed: the mouth nearly as wide as the head; the lower jaw the longest, bearded or fringed all round the edge; both jaws are armed with numerous teeth of different lengths, conical, sharp, and curving inwards; there are teeth also on the palatine bones and pharyngeals; three elongated unconnected filamentous rays stand on the upper part of the head, two of them near the upper lip, one at the nape, and all three are situated in a mesial furrow; the eyes are large, the irides brown, and the pupil black: the pectoral fins are broad and rounded at the edge, and wide at the base; the branchial pouches are distended by the six branchiostegals. The body, which is narrow compared with the breadth of the head, tapers gradually to the caudal fin; the vent is situated about the middle of the body.

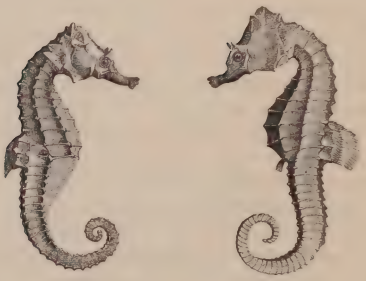
Colour of the whole upper surface of the body an uniform brown, the fin membranes darker; the under surface of the body, the ventral, and pectoral fins, are white; tail-fin dark brown, almost black.

Mr. Couch informs me by letter that he has reason to believe he saw a specimen of *Lophius parvipinnis* of Cuvier, and regrets that circumstances prevented his taking a minute description. It was of small size, scarcely exceeding fifteen inches in length, thicker in form than the common Angler, with somewhat of a different structure of the pectorals, and regularly and even beautifully mottled with black patches.

Two short notices by British ichthyologists of another species of *Lophius* are supposed to refer to mutilated examples of *L. piscatorius*, or to specimens deformed in drying.

THE ANGLER, AS SEEN FROM ABOVE.

Nec minor solertia ranæ quæ in mare PISCATRIX vocatur. PLINIUS.



THE SHORT-NOSED HIPPOCAMPUS.

Hippocampus brevirostris, Kaup, Lophob. Br. Mus. Cat. 7.
,, *Rondeletii*, Willughby, p. 157, I. 25, fig. 3 (not exact).
,, *brevirostris*, *Sea-horse*, Jenyns, Man. Brit. Vert. p. 489.

Syngnathidæ. *Family Characters.*—Lophobranchs having a small, circular gill-opening situated high up, close to the compressed occiput. One dorsal fin only standing over the anal region or nearly so. Form elongated. Ventrals wanting; anal fin very small, in some genera absent. The males have egg-pouches.

Hippocampus. *Generic Characters.*—Occiput more or less elevated and crowned by a coronet of spines and knobs: orbits denticulated. Body-mail composed of from ten to thirteen rings, of which the pectoral ring is furnished with two or three spinous points. Tail prehensile without a caudal fin; caudal egg-pouch formed of thick skin, opening at its commencement only.

The *Lophobranchs* constitute an order of fishes characterized first by Cuvier. They have a peculiar aspect from the jointed armour in which they are encased, an osseous skeleton, and complete and free jaws; but the ultimate divisions of their gills, instead of being

ranged like the teeth of a comb in single or double order, are clustered into small tufts, which are placed by pairs along the branchial arches.* The tubular elongated face is formed of the nasal, vomer, tympanals, preopercula and subopercula, and the nasal bone is a short compressed vertical plate. The pouches, in which the males of the most characteristic genera carry the eggs until they are hatched, are the most interesting features of their economy. In some genera the egg-pouches are developed on the breast or belly; in others, on the tail; and in some the eggs are merely glued on in rows, or lodged in pits, and are not covered by membrane. This provision for the safety of the future generation has been thought to be analogous to the pouches of the Australian Marsupials, or to the fold of skin in which the Wandering Penguin carries its solitary egg over the desert tracts of the ocean.

Pennant, in the first edition of his British Zoology, published in 1776 and 1777, states that he had received information of the *Syngnathus Hippocampus* of Linnæus, or what the English improperly call the Sea-horse, having been found on the southern shores of this kingdom. John Walcott, Esq., whose MS. History of British Fishes was written in the years 1784 and 1785, says, in reference to a drawing of a female specimen, "This was taken on the coast of Hampshire, and given to me by the late Mr. Brander." L. W. Dillwyn, Esq. obtained a specimen of *Hippocampus* on the Dorsetshire coast; and Messrs. C. and J. Paget, in their sketch of the Natural

* The tufted filamentous gills of the Lophobranchs are compared by Milne Edwards to the filamentous branchiæ of a Tadpole; and Rathke, who has investigated their structure, informs us that each is framed of a short delicate ligamentous stem, to which the respiratory processes are attached by repeated doublings of the branchial membrane, the folds widening, as they recede from the base, so as to form an inverted cone or club-shaped tuft.

History of Yarmouth, state that the *Hippocampus* is also occasionally met with there.

According to Mr. Thompson, the Hippocampus has been taken in various parts of Ireland,—namely, at Belfast, in Red Bay in the county of Antrim, in Dublin Bay, and at Youghal.

Dr. Kaup, who by an extensive comparison of specimens in the British Museum with those in the several continental Museums, has been enabled to furnish the comprehensive list comprised in the catalogue of the Lophobranchii, published by the Trustees of the British Museum, confirms the allocation made in the first edition of British Fishes of the *Hippocampus* of our seas to the *brevirostris* of Cuvier. He found very many specimens in the Paris, London, Leyden, Vienna and other Museums, and thereby ascertained that it is an extremely common species throughout the North Atlantic and the Adriatic seas.

To F. C. Lukis, Esq., of Guernsey, I am indebted for the male and female specimens from which the figures at the head of this article were taken; and to the same gentlemen I owe the following communication, dated at Guernsey on the 9th of June, 1835, at which time he had had two healthy female specimens confined in a glass vessel under observation for twelve days. "An appearance of search for a resting-place induced me," says Mr. Lukis, "to consult their wishes by placing seaweed and straws in the vessel: the desired effect was obtained, and has afforded me much to reflect upon in their habits. They now show many of their peculiarities, and few subjects of the deep have displayed, *in prison*, more sport or more intelligence."

"When swimming about, they maintain a vertical position; but the tail, ready to grasp whatever meets it

in the water, quickly entwines itself in any direction round the weeds, and, when fixed, the animal intently watches the surrounding objects, and darts at its prey with great dexterity."

"When they approach each other, they often twist their tails together, and struggle to separate or attach themselves to the weeds; this is done by the under part of their cheeks or chin, which is also used for raising the body when a new spot is wanted for the tail to fasten upon afresh. The eyes move independently of each other, as in the chameleon; this, with the brilliant changeable iridescence about the head, and its blue bands, forcibly remind the observer of that animal."

The vignette at the end of this article, in illustration of the habits here described, was copied from a drawing by Mr. Lukis, most obligingly lent to me for this purpose. This gentleman has taken the Hippocampus on the Hampshire coast, as well as in the Channel Islands.

By the kindness of William Walcott, Esq., I learn that an attentive observer of the Island of Jersey remembers having more than once seen specimens of *Hippocampus* curled up in oyster-shells. About four years since, a specimen was shown at Southampton, which lived more than a fortnight in a glass globe. This was said to have been obtained on the French coast near Granville, and was brought to Southampton, by one of the sailors of a steam-packet; I have also heard of one that lived three weeks in confinement at Harwich, the undulating motion of which when swimming was performed with great ease, and was very interesting to observe.

The *Hippocampi* resemble the *Syngnathi* in their sexual peculiarities, as far as they have been investigated. I had the pleasure, in company with Professor Owen, of

examining some specimens in the collection of the Royal College of Surgeons, whose internal structure had been partly exposed to view by the dissections of John Hunter. The females with the abdomen enlarged, as shown in the right-hand figure at the head of this article, have a small anal fin of four rays, but no true pouch, and their ova exist in the abdomen. Males have no anal fin, in any of the specimens I have examined, but an obvious pouch, and their abdomen is smaller than in the females, as shown in the left-hand figure. The two specimens represented in the vignette at the end are both females.

Their food is unknown to me, but is probably very similar to that taken by the Pipe-fishes.

The whole length, from the point of the nose to the end of the tail, is about five inches, and the tubular face is considerably shorter than the rest of the head: the eyes are prominent, the irides straw yellow; over each eye there is a single conical tubercle: five prominences compose an occipital coronet whereof the distal one on the medial line is connected to the sharp crest of the pectoral ring; at certain times the cranial points support cutaneous filaments, which are shown in Willughby's figure: the operculum is marked thickly with striæ, radiating from the front: the pectoral fins, placed immediately behind the operculum, are small, and apparently contain about eight rays in each: the form of the body is heptangular, with three ridges on each side, and a seventh ridge running lengthwise in the mesial plane of the abdomen; the back is flat; the rings of the body are eleven, with tubercular projections at the joints; the rays of the dorsal fin number about sixteen, and the anal fin, which is peculiar to the female, probably performs some function at the time of the transfer of the ova to the pouch of the male; this anal fin contains four rays: the abdomen is as

deep again as the tail; from the vent the form of the tail is quadrangular, ending in a point, and the number of its segments is about thirty.

The general colour is a pale ash-brown, relieved by a changeable iridescence, and variable tints of blue dispersed over different parts of the head, body, and tail.

Vera ut fiat vulgi opinio, quidquid nascatur in parte naturæ ullâ, et in mare esse : præterque, multa, quæ nusquam alibi. . . . Quo minus miremur equorum capita in tam parvis eminere cochleis.—Plinii *Hist. Nat.*, ix. 1.

THE GREAT PIPE-FISH, OR NEEDLE-FISH.

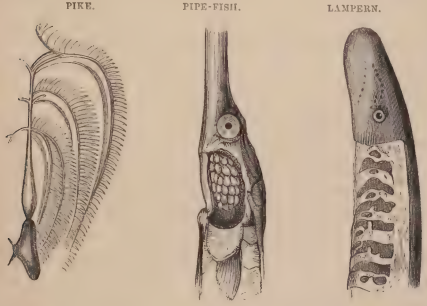
TANGLE-FISH, *Scotland.*—PIBELLBYSG, *Wales.*

Syngnathus Acus, LINNÆUS. BLOCH, pl. 91, fig. 1, young; fig. 2, adult.
,, ,, *Longer Pipe-fish*, PENN. Brit. Zool. iii. pl. 26. Upper figure female; lower one male.
,, ,, KAUP, Lophob. Brit. Mus. Cat. p. 41.

SYNGNATHUS. *Generic Characters.*—Egg-pouches open thoroughout: tail never prehensile. No spines before the eye on the straight, slender, cylindrical face. Body heptagonal, its dorsal surface flat or flatly concave, and never greatly compressed, nor ever bent upwards into an arch: rings of the body-mail fewer than twenty-four, the caudal rings much more numerous: but the upper edge of the tail is either continuous with the lateral line of the body or interrupted where that line terminates, and is never on the same line with the superior edge of the back. Dorsal fin seated on the plane of the back, not on an elevated base.

As examples of three of the various types of structure of the gills of fishes, the vignette on the following page exhibits the pectinated gills of the Common Pike, an osseous fish, with cycloid scales; also the tufted gills of the Great Pipe-fish, a Lophobranch, protected by ganoid scales; and thirdly, the branchial sacs lined by the gills

of a River Lampern, a Dermopterous fish with a cartilaginous skeleton. The respiratory apparatus of the last-named order of fishes has been fully described, and illustrated in the early part of our first volume. The heart and gills are isolated in the left-hand figure, and in the other two figures the integuments have been only partially removed. The delicate gill-tufts of the Pipe-fishes are defended by a large and hard operculum, which in the genus *Syngnathus* is traversed by a prominent longitudinal line running either entirely across or only partly so. This variation in external structure furnishes a character for the convenient division of the numerous species of the genus. *S. brevirostris* belongs to the group which have the keel restricted to the forepart of the gill-plate.



Syngnathus acus, or the Great Pipe-fish, is one of the most common of the Lophobranchs, and is found on many parts of the coast, sometimes at low-water among sea-weed, at other times in deep water. It is believed that the habit of proceeding to deep water at two different periods of the season has reference to important

and interesting circumstances connected with the production of the young.

In a MS. History of British Fishes, written by the late John Walcott, Esq., during his residence at Teignmouth, in the years 1784–5, and kindly permitted by his son, William Walcott, Esq., to be used in the History of British Fishes, there is a statement in reference to the sexes of *S. acus*, which has since been confirmed by four Continental naturalists, and which I have verified by repeated examinations. Mr. Walcott's observations are as follows:—

"The male differs from the female, in the belly from the vent to the tail fin being much broader, and in having for about two-thirds of its length two soft flaps, which fold together, and form a false belly (or pouch). They breed in the summer; the females casting their roe into the false belly of the male. This I assert from having examined many, and having constantly found, early in the summer, roe in those without a false belly, but never any in those with; and on opening them later in the summer, there has been no roe in those which I have termed the female, but only in the false belly of the male."

On dissecting males and females the proof of the correctness of this new view was obvious. The anal or subcaudal pouch is peculiar to the males only, and is closed by two elongated lateral flaps. On separating these flaps, and exposing the inside, the ova, large and yellow, were seen lining the pouch in some specimens, while in others the hemispheric depressions from which the ova had been but recently removed were very visible. In each of these the opened abdomen exhibited true male organs. The females had no anal pouch, and when the abdomen was laid open two ovaria containing ova of large size were exposed. In a specimen of a male of *S. acus*, obtained at Dover on

the 20th of July 1835, and for which I am indebted to W. Christy, Esq., the opened abdomen exhibited the male organs; and the sub-caudal pouch contained many eggs, the young of some being fully developed, and ready to burst the capsules, while from others of the eggs the young had actually escaped.

In the plate devoted to *Syngnathi*, in the last two octavo editions of Pennant's British Zoology, the upper figure represents the female, and the second figure the male of *S. acus*. The enlargement on the under surface of the second figure, looking like an elongated fin, marks the situation of the distended pouch of a male. Pennant's third figure is the *Nerophis anguineus*, and the fourth the *N. lumbriciformis* of this work. Neither *Siphonostomus typhle* nor *Nerophis æquoreus* are figured by Pennant.

How the ova are transferred from the abdomen of the female to the sub-caudal pouch of the male is, I believe, unknown.

Mr. Walcott adds, that *S. acus* begins to breed when only four or five inches long. Of this I have also obtained proof; and although examples of this species not uncommonly occur of eighteen inches long, and Bloch attributes to it a length of two or three feet, I have a specimen, four inches long only, a young fish apparently of the preceding year, with full-grown ova, in the two ovaria.

M. Risso notices the great attachment of the adult Pipe-fish to its young, and this pouch probably serves as a place of shelter to which the young ones retreat in case of danger. I have been assured by fishermen that if the young were shaken out of the pouch into the water over the side of the boat, they did not swim away, but when

the parent fish was held in the water in a favourable position, the young would again enter the pouch.

The figure of *S. acus* by Rondelet is correct, and below it several of the young are represented as swimming near the abdomen of the parent fish. This figure is copied by Willughby (plate I. 25, fig. 6).

Mr. Couch says, "This species may be seen slowly moving about in a singular manner, horizontally or perpendicularly, with the head downwards or upwards, and in every attitude of contortion, in search of food, which consists chiefly of water insects."

From the great similarity in the form and size of the mouth in all the species of Pipe-fish, it is probable that their food is also similar. Worms, small mollusca, young and minute thin-skinned crustaceans, and the ova of other fishes, are among the substances taken; and these *Syngnathi* are supposed to be able, by dilating their throat at pleasure, to draw their food up their cylindrical beak-like mouth, as water is drawn up the pipe of a syringe.

From the point of the tubular mouth to the posterior edge of the bony operculum, the distance is, to the whole length of the fish, as one to eight; if measured to the edge of the shoulder, it is as one to seven and a half, and this proportion exists in specimens of various ages or lengths, from six inches to eighteen; from the mouth to a projecting point at the anterior edge of the eye, and thence to the origin of the pectoral fin, the distances are equal: the face is tubular, slightly compressed, and denticulated on its dorsal aspect; its depth is but one-third of that of the head at the deepest part, which is in a vertical line passing through the centre of the operculum: the mouth is small, placed at the extremity of the tube, opening obliquely upwards, the lower jaw being the

longest: the eyes are rather large, the upper edge of the orbits prominent, and acute, the raised line being continued to the hind-head, which is oval, convex, and has a denticulated crest: operculum covered with radiating striæ: the space between the eyes is flattened: from the pectoral fin to the anal aperture the body is deep and heptangular, with three ridges along each side, and one along the abdomen, which ends at the vent; the body is defended by a series of nineteen plates; throughout the short extent of the dorsal fin the section is hexangular, the ridge of the abdomen being discontinued; thence to the end of the tail the form is tapering, slender, and quadrangular, with a series of forty-four plates; the dorsal stands on nine or ten rings, its tallest rays not equalling the height of the body; the pectoral fins are small, and the anal fin is very small.

The fin-rays in number are—

D. 40: P. 12: A. 4: C. 10.

The prevailing colour is pale brown, transversely barred with darker brown.

This species appears to be common on the shores of the British Islands generally.

SYNGNATHUS ACUS.

THE DEEP-NOSED PIPE-FISH.

Siphonostomus Typhle, Bonap. Cat. Meth. t. 5, f. 42.
,, ,, Kaup, Lophobr. Brit. Mus. Cat. 49.
Syngnathus ,, Linnæus.
Acus Aristotelis *Typhle antiquorum*, Willughby, p. 158, I. 25, f. 1.
Syngnathus Typhle, *Shorter Pipe-fish*, Donov. Brit. Fish. pl. 56.
,, ,, ,, ,, Flem. Brit. An. p. 175, sp. 35.
,, ,, *Lesser Pipe-fish*, Jenyns, Man. Brit. Vert. p. 485.
Siphonostoma acus, Rafinesque, p. 35.

Siphonostomus. *Generic Characters.*—Pectoral ring cleft on its ventral aspect in the middle of its length. Face greatly compressed, and extended evenly in the plane of the forehead. Long, moderately-thick, fishes, with the dorsal fin imposed on from eight to ten rings almost all caudal.

The Deep-nosed Pipe-fish is immediately recognised by the compressed form of the face, which is so deep that the upper and lower profiles are nearly parallel with the lines of the upper and under surface of the rest of the head. From the two large-sized British Pipe-fishes which follow, this species is easily distinguished by the presence of pectoral, anal, and caudal fins. The figures in the works of Willughby and Mr. Donovan are good portraits; but I believe the figure in Bloch, plate 91, f. 1,

which has usually been referred to as *Syngnathus typhle*, to be only a representation of the young of *S. acus*.

S. Rondeletii of M. Laroche, Ann. de Mus., tome xiii. p. 324, pl. xxi. f. 5, or *S. viridis* of M. Risso, figured by Guerin, is a distinct species, characterized by the depth of the furrow that separates the forehead and orbits, and other peculiarities.

The Deep-nosed Pipe-fish does not differ materially in its habits, that I am aware of, from the *Syngnathus* last described. The ova are transferred from the abdomen of the female to the sub-caudal pouch of the male, and there hatched in the same manner. When fishing in ten or twelve feet water over a soft surface covered with weeds, using the keer drag described and figured in vol. ii. p. 36, I have taken both sorts together, finding the deep-nosed species abundant on the Dorsetshire and Hampshire coasts. Dr. Parnell has obtained this species in the Frith of Forth; Mr. Couch includes it in his Cornish Fauna, and Mr. Thompson has found it on the coasts of Antrim and Cork.

The whole length of the largest specimen I have seen was thirteen inches; from the point of the closed jaws to the posterior end of the bony gill-cover, the distance is, compared to the whole length of the fish, as one to six; the head is larger than in *S. acus*, and wants the elevated ridge on the top of it; the distances from the point of the upper jaw to the projecting tubercle in front of the eye, and thence to the end of the pectoral fin, are equal; the face is very much compressed, and nearly as deep as the head, only slightly inclining to a slope before the eyes; the body is hexangular; the middle lateral angle on each side becoming at the end of the dorsal fin the upper angles of the quadrangular tail. This fin commences farther back than in *S. acus*, its middle being very

nearly the middle of the whole length of the fish, and it stands on nine or ten rings; the rings between the shoulder and the vent number eighteen, thence to the end of the tail about thirty-seven; but both series are liable to a little variation in number: the abdomen is almost rounded; the anal fin is minute, and the caudal fin pointed, the two central rays being the longest.

The fin-rays in number are—

D. 39: P. 15: A. 3: C. 10.

The prevailing colour is olive-green, mottled and spotted with yellow-brown and yellowish-white.

SIPHONOSTOMUS TYPHLE.

THE ÆQUOREAL PIPE-FISH.

Nerophis æquoreus, Kaup, Cat. Brit. Mus. p. 66.
Syngnathus æquoreus, Linnæus.
,, ,, *Æquoreal Pipe-fish*, Montagu, Wern. M. 1. pl. 4, f. 1.
,, ,, ,, ,, Penn. Brit. Zool. vol. iii. p. 188.
,, ,, ,, ,, Flem. Brit. An. p. 176, sp. 38.
,, ,, ,, ,, Jenyns, Man. Brit. Vert. 486.
,, ,, ,, ,, Leconby, Mag. N. Hist. for 1858.

Nerophis. *Generic Characters.*—The eggs are deposited in rows on the breast and belly of the males, and have no membranous covering: the body is cylindrical or compressed so as to have an obtusely-oval section; and neither pectoral nor anal fin is present, though some species have a semblance of a caudal fin.

The Æquoreal Pipe-Fish, the largest British species of this genus, was described at length by Colonel Montagu from two specimens obtained on the Devonshire coast, but had been noticed long before in 1684, by Sir Robert Sibbald, who attributes to it the length of two feet.

Of this species I am indebted for one example to the kindness of Dr. Embleton, of Newcastle-upon-Tyne, who obtained it on the coast of Berwickshire; and for two from the Isle of Man to Mr. Wallace. It has been captured on the adjoining Scottish coasts, and

Mr. Thompson mentions that it occurs occasionally on every side of Ireland. Mr. Selby has obtained it on the coast of Northumberland, and it has been found by F. C. Lukis, Esq., at Guernsey. Mr. Couch does not appear to have found more than two or three specimens, but the Cornish fishermen say, that they sometimes see this fish at the distance of ten or fifteen leagues from the land, swimming on the surface of the sea in fine weather, in places where the depth of water exceeds fifty fathoms.

The following is the description of a specimen which was taken at Scarborough in 1858, and which we have been permitted to examine, by the kindness of John Leconby, Esq., and of Mr. Alfred Roberts, Curator of the Museum of that place.

The specimen in its dry state measures 17·75 inches, of which 8·45 inches belong to the head and trunk, and 9·30 inches to the tail. The total length comprises twelve and a half lengths of the head: there are thirty rings or lateral plates between the gill-opening and the vent, including the plate over the latter orifice, and sixty-six behind it, the rings becoming very small towards the slender, tapering tip of the tail. The dorsal fin stands on thirteen dorsal plates ending in the middle of the last one, and four of these plates are wholly behind the vent. Mr. Roberts states that when alive the body had "a sharply-compressed oval section, and the tail was round from the vent to within three-quarters of an inch of the end, whence it was flattened to the tip." When dry, the tip of the tail is compressed, but very slender and tapering, and for less than a line's breadth, which is the extent of the soft parts beyond the extremity of the vertebral column, the integument is wrinkled so as to resemble thick irregular fin-rays; but on softening the part in water the extreme tip becomes plump, slightly compressed, and

shortly conical, the semblance of rays wholly disappearing. In the dorsal fin there are forty-four rays that have not the usual taper form, but seem to be mere albuminous flexuose thickenings of the membrane, of equal diameter from the base to the extremity: in the dried specimen they are edged with black, and are very conspicuous on the whitish membrane. The fin is highest in the middle, and rounds off at each end. No vestige exists of pectoral fins. Twenty-one dorsal shields cover the back saddle-wise before the fin, and there are two narrower ones on the nape, making twenty-three in all, before the dorsal fin. An elevated line traverses each side of the dorsal shields nearly to the end of the tail, where it becomes obsolete; and there are two less prominent lines on the lower part of the side, the undermost ending at the vent, but the other being continued on the tail. A mesial line less distinctly marked runs along the summit of the back, and there is a corresponding line as far as the vent along the middle of the belly. Even in the dried fish these lines do not render the body distinctly octagonal, but the tail assumes in part an obscurely quinquelateral shape.

The small round eye is close to the profile, and as nearly as possible in the middle of the length of the head; and an obtuse smooth angle is formed on each side of the sub-cylindrical face by the ridge-like bending of each inter-operculum, but no mesial crest exists either above or below. The usual facial and temporal furrows are present, and at the posterior end of the former, close to the orbit, two small nasal openings are encompassed by a circular membrane. A boldly-convex operculum closes the gill-opening, leaving a small orifice at the upper angle for the passage of the water of respiration. The jaws suspended at the extremity of the face are destitute of teeth.

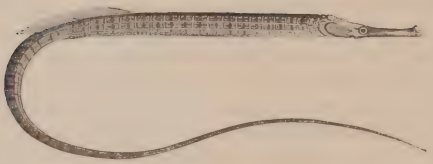
In a drawing made of the fish when living in captivity the general colour of the back, the upper parts of the sides and the tail are represented as being light reddish-brown or fawn-coloured, and the sides of the head and the belly golden-yellow; a series of vertical whitish stripes with black edges extend from the gill-opening to a little way beyond the vent, formed of a stripe down the middle of each ring, and one between each pair of rings, or twice as many stripes as there are rings. The stripe on the humeral chain is binate and anastomosing. There are many minute pale specks on the top of the head.

This individual lived six or seven weeks in the vivarium of the Scarborough Museum, passing most of its time in a branch of *Laurencia pinnatifida* in company with a fresh-water Eel, but sometimes swimming with its body arched, and its tail curved and recurved. It was found dead with its head up as if alive.

Dr. Kaup gives as diagnostic characters of this species the position of the front of the orbit exactly midway between the tip of the snout and the extremity of the gill-cover, the convexity of the forehead, and the short, abrupt six-rayed caudal fin. In the Scarborough specimen the small eye is *half its diameter* nearer the point of the snout, and the form and structure of the caudal fin is as described above. Even in the dried specimen the tip of the tail is slender and acute, and though six folds become visible under a lens in the very short sub-diaphanous point beyond the last vertebra, these semblances of rays are lost by maceration, though they return again on drying. Dr. Kaup adds that the largest specimens measure two feet, that the body is composed of twenty-nine or thirty rings, and the tail of from sixty-eight to seventy; that the dorsal, supported by from forty to

forty-four rays, stands on twelve or thirteen rings, of which three belong to the tail, and that the female has a rudimentary dorsal and an octangular body, while the male has a flatter back and belly and the anal orifice nearer the head, that opening being in the female in the middle of the length. The eggs are attached to the male in from eight to ten rows. The species seems to inhabit the northern seas exclusively, having been hitherto discovered only at Havre, among the British Islands, and on the coasts of Norway.

NEROPHIS ÆQUOREUS.



THE SNAKE PIPE-FISH.

Nerophis anguineus, Kaup, Cat. Brit. Mus. p. 65.
Syngnathus anguineus, *Snake Pipe-fish*, Jenyns, Cat. Brit. Vert.
,, *ophidion*, *Serpent de Mer*, Bloch, pl. 91, fig. 3.
,, ,, *Snake Pipe-fish*, Shaw, Gen. Zool. v. 453, pl. 179.
,, ,, *Longer Pipe-fish*, Low, Faun. Orcad. p. 179, sp. 1.

No Lophobranch can better deserve the name of *anguineus* (little snake), than the present. It is immediately distinguishable from the fish last described, with which alone it is likely to be confounded, by its much more slender as well as rounder body, which scarcely exceeds a goose-quill in size, and by the whole of the dorsal fin being, in a specimen of fourteen inches long, more than half an inch before the middle of the fish. Pennant has figured this fish, No. 61 of plate 26, but has not described it.

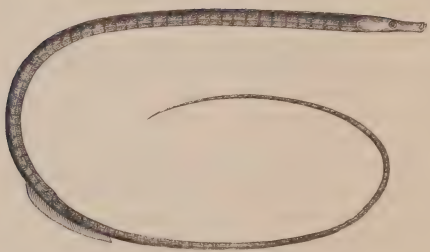
In this species, as well as the preceding one, neither male nor female possesses an anal pouch, but the ova after exclusion from the abdomen of the female are carried for a time by the male in separate hemispheric depressions on the external surface of the abdomen, anterior to the

anus. The females have no such depressions. The sexes have been determined by examination of the internal structure. All the specimens inspected having these external hemispheric cells were proved to be males, by the existence of milt in the abdomen; those without external depressions were all females, being provided internally with two lobes of enlarged roe. The males of this species, taken by me as late in the season as August, had one ovum of the size and colour of a mustard-seed lodged in each cup-shaped cell. These specimens were caught with a keer drag-net between Brownsey Island and South Haven, at the mouth of Poole Harbour. Many specimens of *Syngnathus acus* and *Siphonostomus typhle* were obtained at the same time and place; and this species has been taken also on the north-east, south, and west coasts of Ireland.

The length of the head, in proportion to the whole length of the fish, is as one to eleven; the form of the body is slightly octangular, but more slender and rounded than in that last described; it is uniform in size as far as the vent, then tapers gradually to the end of the tail, which is slightly flattened; the divisions between the rings and the angles of the body are almost obsolete; the dorsal fin is, as before mentioned, entirely anterior to the middle of the fish; its rays number thirty-eight: the vent is under the last fourth portion of the dorsal fin.

The colour of the body is a uniform olive-green; the irides red, the pupils black. The specimens I possess vary in length from eight to fourteen inches.

NEROPHIS ANGUINEUS.



THE STRAIGHT-NOSED PIPE-FISH.

Nerophis ophidion, Bonap. Cat. Méth. p. 91.
,, ,, Kaup, Cat. Brit. Mus. 70.
Syngnathus ,, Linnæus, Syst. Nat. t. i. p. 417, sp. 5.
,, ,, *Worm Pipe-fish*, Jenyns, Brit. Vert. p. 488.

It is only within a few years, I believe, that writers on the Natural History of European Fishes have become aware that in quoting, as was almost invariably the case, the figure of the *Syngnathus ophidion* of Bloch, tab. 91, fig. 3, as the true *ophidion*, they were not referring to the true *Syngnathus ophidion* of Artedi and Linnæus, which that figure does not represent.

The first good figure of the true *S. ophidion* of Linnæus that became known to me appeared in an octavo volume on the Fishes of Mörcö, in Sudermannland, a province in Sweden, published by M. C. U. Ekström, at Berlin in 1835, a copy of which came into my possession in the autumn of 1836. In 1838, a figure of the head of this fish was published in M. Wiegmann's

Archives of Natural History in illustration of a paper on the Swedish *Syngnathi* by M. B. Fr. Fries of Stockholm; and this fish having been obtained on the British coast by others as well as by myself, a figure of it is given of the natural size. It differs from the two preceding members of the genus *Nerophis* in having, when mature, no semblance of a caudal fin. This species, which lives among the sea-weed on our coast, was found in Cornwall long ago by our countryman and naturalist John Ray, has been recently described by Mr. Jenyns in his Manual of British Vertebrate Animals, from specimens obtained at Weymouth, and is pretty abundant on the Dorsetshire and Hampshire coasts, where the shrimpers often find it in their nets. Mr. Charles Barron says that he has often seen it swimming in clear water, near the surface, and greatly admired the graceful movements of its slender bright green body. The Rev. George Harris having kept one obtained in 1851, at Gamrie on the Banffshire coast, in captivity for some time, observed that it respired regularly about thirty times in a minute.—*Zoologist*, 3119.

This species is long, slender, and nearly cylindrical, being but slightly compressed from the head to the vent, and from thence to the end of the tail round, and gradually tapering to a very fine point. The head forms about one-seventeenth part of the whole length, and the vent is a little posterior to the middle of the fish. In one specimen there are twenty-nine lateral plates between the gill-opening and vent, and in another thirty, including in both instances the plate over the vent. In addition to these there is a small nuchal plate anterior to the gill-opening. It is difficult to count the joints or plates of the tail owing to their minuteness towards the end, but one specimen that measured nine inches of total length was found to contain seventy-five lateral caudal plates,

and another that was an inch shorter had seventy-nine caudal plates in a row.

The head is moderately compressed, its upper profile being straight, and the face surmounted by a thin even crest that extends from the upper jaw to between the nostrils. An equally acute under profile is formed by the thin edges of the interopercula pressed against each other. To the anterior ends of the bones just named, the mandible is hinged so as to shut up in front of the upper jaw, and render the small orifice of the mouth nearly vertical. On the sides of the face there is a longitudinal low keel, that traverses the convex interoperculum and forms the lower border of the orbit; and higher up a cutaneous furrow runs somewhat obliquely from the premaxillary to the small triangular membrane which surrounds the orifices of the nostrils immediately in front of the orbit. The cranium is transversely rounded off without any elevated lines, and is separated from the convex gill-plate by a furrow, which, commencing at the posterior part of the orbit, inclines upwards, and terminates at the upper angle of the gill-opening. At that angle a small orifice remains when the rest of the gill-opening is closely shut, and has probably a similar function to the like orifice of a Goby, which suffices for the transit of the respiratory fluid when the gill-cover is pressed against the shoulder. Twelve rings support a dorsal fin, formed of a delicate membrane, extended on forty-one slender, unjointed rays. The vent is under the fifth of these rings.

A specimen, on the third day after it was taken from the sea, had a yellowish-green colour with a golden metallic lustre, an interrupted prussian-blue line on the inferior border of the facial groove and the lower edge of the orbit, together with many blue spots on the upper part of the face; three blue lines radiated from the pos-

terior angle of the orbit over the preoperculum; others descending from the temporal groove bent at a right angle on the disk of the operculum, and were crossed by two or three longitudinal lines of the same colour. The lateral stripe formed by the loose aggregation of these various lines on the side of the head, was continued behind the humeral by a conspicuous dark tapering stripe, composed of many contiguous parallel lines, which vanished about the ninth or tenth ring of the torso; but vestiges existed more posteriorly of many small, pale spots. As the specimen dried, seven longitudinal keels became faintly visible on the body, and the cranium and adjoining plates became dotted by small pits. The size of this species rarely extends beyond eleven or twelve inches.

LUGSAIL BOAT.

THE WORM PIPE-FISH.

MOR NEIDR, *Wales.*

Nerophis lumbriciformis, Bonap. Cat. Méth. p. 91.
Acus ,, Willughby, p. 160.
Syngnathus ophidion, *Little Pipe-fish*, Penn. Brit. Zool. iii. 187, pl. 26.

The Worm-like Pipe-fish is the smallest of the British species, and is taken on various parts of the coast. Mr. Low mentions that it is found in Orkney under stones; and Mr. Couch finds it in similar situations on the coast of Cornwall, where it is considered common. Mr. Thompson has recorded it as occurring on all sides of Ireland: and Dr. Kaup mentions that it inhabits the German coasts of the North Sea.

Pennant has figured this species with the ova attached to the surface of the abdomen, as in the species last described, and not being aware of the peculiarity of the male Pipe-fishes carrying the eggs, says, very naturally, "On the belly of the female is a long hollow, to which adhere the eggs, disposed in three rows."

This species does not exceed five inches or five inches and a half in length, and the wood-engraving at the head of the page is a representation of the fish nearly of its

natural size. It possesses when adult no fin except that on the back, which in the specimen I examined contained thirty rays. The face is very short, and is curved a little upwards with the eyes prominent; from the point of the jaws to the posterior edge of the orbit, and thence to the end of the operculum, the distances are equal; the length of these two portions combined bears a proportion to the whole length of the fish of one to twelve; the body is nearly cylindrical, and the vent is situated at the end of the first third of the whole length, with nineteen rings before it, and three-fourths of the dorsal fin behind it; from the vent the fish tapers gradually to the point of the tail; the number of rings between the vent and the tail-end is about fifty. The surface of the body is more smooth than in the two species previously described, and the colour is dark olive-green.

In 1837 the late Professor B. Fries, of Stockholm, published an interesting paper on the great change which takes place in this species during its growth, namely, the young on their escape from the egg have the entire tail covered with a fin-like membrane, which extends partly up the back, and also along the under surface as far as the anal aperture: they have also pectoral fins. Except the portion required to form the permanent dorsal fin, all these, at a subsequent unknown period, are thrown off in a way similar to the rejection of their tails by Tadpoles on becoming Frogs. The absorption of the pectoral and caudal fins is the novelty in this case; the existence of the dorsal and anal membrane and its subsequent partial absorption having been previously known to occur in the young Salmon.

THE PIG-FACED TRIGGER-FISH, OR FILE-FISH.

Balistes capriscus, Gmelin, 1471. Bloch. Schn. 476.
Capriscus Rondeletii, *Pesce Balestra*, Salv. Willugh. 152, I. 19.
Balistes capriscus, *Mediterranean File-fish*, Jenyns, Brit. Vert. p. 492.
,, ,, *et Buniva*, Lacep. I. 372 and V. 21.
,, *castaneus*, Richardson, Voy. of Sulph. pl. 59, f. 5.
,, *fuliginosus*, Dekay, N. York Fauna, 389.

Balistidæ. *Family Characters.*—Face conical, terminated by the small mouth; teeth incisoriul, more or less tapering, few. Skin protected by shield-like ganoid scales, or by small rough points. Branchiæ three only. Swim-bladder ovate, strong.—In the sub-family *Balistini* the ganoid mail is divided by intersecting lines into rhomboidal disks, and the stout anterior ray of the first dorsal is followed by one or two small ones: the pubic bones project more or less, and support the longitudinally-ranged ventral spinules.

Balistes. *Generic Characters.*—Form compressed. A soft smooth dermal furrow before the eye: shields behind the gill-opening: teeth conical, elongated, incisorial, without projecting back-teeth. Sides of the tail smooth or armed: caudal round, even, or crescentic: face wholly scaly, or with more or less extensive naked spaces.

The first example of this genus which has occurred in the English seas, that I am aware of, was taken off the Sussex coast in the month of August 1827; and J. G.

Children, Esq., having obtained the specimen, recorded this interesting capture in his address delivered at the anniversary meeting of the Zoological Club of the Linnean Society on the 29th of November of the same year. This specimen has since been deposited in the national collection of the British Museum; and by the kindness of the officers of the natural history department of that establishment, I have been permitted to take a drawing and description from the individual fish caught in our seas.

Since the publication of the preceding paragraph in the first and second editions of British Fishes, Dr. Melville has taken a specimen in the Bay of Galway in 1853, as recorded in Thompson's Natural History of Ireland. Dr. Baikie also mentions a third example of this fish as having been caught at North Ronaldsey in 1827 or 1828, and being now in the possession of William Trail, Esq., of Woodwick.

The *Balistes capriscus* is a species well known to the older authors as an inhabitant of the Mediterranean; is figured by Salvian; by Grew, in his Rarities, tab. 7; and by Klein, tab. 3. It has, however, though rare in our seas, a cosmopolite distribution throughout the warmer and temperate parts of both oceans, as well as in the Mediterranean.

The Plectognaths, as Cuvier named the order of fishes to which *Balistes* and some other genera which follow belong, are included by Agassiz among his Ganoids. Though their bones are fibrous, their skeletons are tardily and imperfectly ossified, and they have only rudimentary ribs, but they have no more than two valves at the commencement of the arterial trunk, and therefore differ in that essential part from the true Ganoids as well as from the Chondropterygians, all of which have many valves at the base of the arterial system. Their distinctive cha-

racter consists in the union of the maxillaries and premaxillaries, as the name of the order denotes. Their swim-bladder has no air-duct, and they have no pancreatic cæca. The pectinated processes of the biserial gills, instead of being united to the septum in pairs, as usual, are in these fishes alternate, the processes of one layer standing in the intervals of those of the other layer.

The first and strongest spine of the back in this fish is studded up the front with numerous small projections, which under the microscope have the appearance of so many points of enamel or pearl arising from the surface of the bone, giving it a rough denticulated appearance; and hence the name of File-fish. The second smaller spine has in the fore part of its base a projection which, when the spines are elevated, locks into a corresponding notch in the posterior base of the first spine, and fixes it like the trigger of a gun-lock; from which the fish is called in Italy *Pesce balestra*. The strong spine cannot be forced down till the small one has been first depressed and the catch disengaged.

The length from the nose to the gill-opening is to the whole length of the fish as one to four; the depth of the body is rather less than half the whole length, the caudal fin being included in both measurements: the body is compressed; its surface is hard, and the shields being arranged in oblique lines over the whole body no lateral line is observable, except along the middle of the fleshy portion of the tail: the mouth is small and narrow; the visible teeth, four on each side above and below, are incisor-like, or cutting; the forehead is wide between the eyes, which are small and enclosed in well-defined orbits; the gill-opening is a short slit which commences at the upper base of the pectoral fin, and ascends obliquely backward; the pectoral fin is of small size: the first spine of the

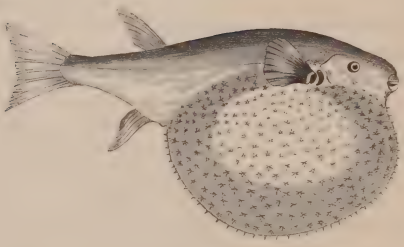
first dorsal fin stands over the gill-opening, the second follows close behind it and is attached by a strong ligament; the third spine is removed farther off, but is connected by membrane: the second dorsal fin is high anteriorly and is long, commencing before the anal, but both fins end on the same plane, and far short of the base of the caudal rays; close before the vent there is a strong rough keel of integument, supported by short rays standing on the pubic bones: the fleshy portion of the tail is free, and rather long; the rays of the caudal are nearly square at the end, and are large and strong.

The fin-rays in number are—

D. 3. 28: P. 15: A. 26: C. 14.

The colour in the dried specimen is nearly a uniform pale brown; rather darker on the back; becoming lighter on the belly, and particularly on the under surface of the head: the smooth naked gums are dark brown. Living specimens are said to be tinged and even spotted with blue. The *Balistes maculatus* of Bloch, t. 151, which has been referred to, *capriscus*, is, according to Dr. Kaup, a distinct form, named by him *Canthidermis maculatus*, and is the same as the *Balistes capriscus* of Cuvier, but not of Salvian or Linnæus.

The whole length of the Museum specimen is nine inches and a half; the depth four inches and three-eighths without the dorsal or anal fins.



PENNANT'S GLOBE-FISH, OR CROP-FISH.

HEULBYSG CROTHOG, *Wales.*

Tetraödon Pennantii,	*Pennant's Globe-fish,*	YARRELL, Brit. Fish. 2nd Ed. ii. p. 457.
,, *stellatus,*	*Stellated* ,,	DONOV. Brit. Fish. pl. 64.
Tetraödon lævigatus,	*Globe Diodon,*	PENN. Brit. Zool. 1776, pl. 20.
Tetraödon lagocephalus,	*Globe Tetrodon,*	PENN. Brit. Zool. 1812, pl. 23.
Tetraödon stellatus,	*Stellated Globe-fish,*	FLEM. Brit. An. p. 174.

DIODONTIDÆ. *Family Characters.* — Teeth incorporated in the gorget-shaped jaws, forming a beak like that of a parrot. The skin more or less completely armed with spines, which are wholly absent in an electric species. In the sub-family of *Tetraödontini* both jaws are divided by a mesial suture, forming, as it were, four great teeth, but each quarter being, in fact, composed of numerous teeth coalescent with the bony substance of the jaw in which they are buried. The variations of the external terminations of the olfactory organ have supplied characters for generic divisions: in some the nerve is expended on an imperforate cutaneous filament, in others on a simple depression not tubular, in others on an open funnel-shaped sac, in others again on a small sac with two openings, and lastly, in others on a short nasal tube.

TETRAÖDON. *Generic Characters.*—The head and tail generally smooth, but the rest of the body of most species armed with short, slender spines that spring from a radiated bony root; in some the sides are smooth, in others the belly only is spiniferous. Most of them have a large air-sac, adhering closely to the peritoneum, and having a valvular communication with the œsophagus by which they can distend their bodies with air. (See vignette.)

Three examples of this curious fish have been procured on the Cornish coasts. Pennant first described it as British from a specimen caught at Penzance. Mr. Donovan has recorded a second Cornish specimen, and mentions another obtained in the European seas. Still more recently a specimen was taken in Mount's Bay, a drawing of which was sent to the Zoological Society by Dr. Boase, and a notice of its occurrence appeared in the Proceedings of that Society for October 1833.

In Ireland this fish was found on Tramore strand, county of Waterford, by Dr. Gabriel Stokes, and again on September 28, 1852, in that same county, near Ardmore, by E. H. Sargint, Esq. (*Zoologist*, 3848). Dr. Baikie also mentions, in the Zoologist (3847), that two specimens have been taken in Orkney.

Pennant called his fish *lævigatus* in the edition of his work published in 1776, and his editor adopted that of *lagocephalus* in the edition of 1812, referring to Linnæus and Bloch; but the figure of the two specimens by Pennant and Mr. Donovan, and the drawing of the third sent to the Zoological Society by Dr. Boase, agree more closely with the figure of the Globe-fish in Grew's Rarities, tab. 7, and with the *Orbis lagocephalus* of Willughby, plate I. 2; these being without spots or stripes are distinct from the *lagocephalus* of Linnæus and Bloch, the spots of which are referred to in the description of the one, and both spots and stripes shown in the coloured figure of the other. Mr. Donovan, when calling this fish *stellatus*, appears not to have been aware of this term having been previously appropriated to an Indian species with black spots; therefore, considering this fish not to have been as yet properly designated, I have given it the name of our highly-esteemed British zoolo-

gist, by whom, as far as I am aware, it was first made known.

"Some species of this genus are remarkable for being provided with the means of suddenly assuming a globular form by swallowing air, which, passing into the crop or first stomach, blows up the whole animal like a balloon. The abdominal region being thus rendered the lightest, the body turns over, the stomach being the uppermost part, and the fish floats upon its back, without having the power of directing itself during this state of distension. But it is while thus bloated and passive, at the mercy of the waves, that this animal is really most secure; for the numerous spines with which the surface of the body is universally beset are erected by the stretching out of the skin, thus presenting an armed front to the enemy on whatever side he may venture to begin the attack."*

The following extract is derived from the very scientific and interesting narrative by Mr. Charles Darwin of the surveying voyages of the Adventure and Beagle, vol. iii. page 13:—"One day I was amused by watching the habits of a Diodon, which was caught swimming near the shore. This fish is well known to possess the singular power of distending itself into a nearly spherical form. After having been taken out of water for a short time, and then again immersed in it, a considerable quantity both of water and air was absorbed by the mouth, and perhaps likewise by the branchial apertures. This process is effected by two methods; the air is swallowed, and is then forced into the cavity of the body, its return being prevented by a muscular contraction which is externally visible; but the water, I observed, entered in a stream through the mouth, which was wide open and

* Dr. Roget. Bridgewater Treatise, vol. i. p. 433.

motionless: this latter action must, therefore, depend on suction. The skin about the abdomen is much looser than that of the back; hence during the inflation, the lower surface becomes far more distended than the upper; and the fish, in consequence, floats with its back downwards. Cuvier doubts whether the Diodon, in this position, is able to swim; but not only can it thus move forward in a straight line, but it can likewise turn round to either side. This latter movement is effected solely by the aid of the pectoral fins, the tail being collapsed, and not used. From the body being buoyed up with so much air, the branchial openings were out of the water; but a stream drawn in by the mouth constantly flowed through them.

"The fish, having remained in this distended state for a short time, generally expelled the air and water with considerable force from the branchial apertures and mouth. It could emit, at will, a certain portion of the water; and it appears, therefore, probable that this fluid is taken in partly for the sake of regulating its specific gravity. This Diodon possessed several means of defence. It could give a severe bite, and could eject water from its mouth to some distance; at the same time it made a curious noise by the movement of its jaws. By the inflation of its body, the papillæ, with which the skin is covered, became erect and pointed. But the most curious circumstance was, that it emitted from the skin of its belly, when handled, a most beautiful carmine red and fibrous secretion, which stained ivory and paper in so permanent a manner, that the tint is retained with all its brightness to the present day. I am quite ignorant of the nature and use of this secretion."

The vignette is copied, on a very reduced scale, from one of the illustrations published in the Catalogue of

the Museum of the Royal College of Surgeons in London, and is thus described:—"The figure in this plate is taken from the large specimen of Crop-fish or Globe-fish (*Tetraödon Pennantii*, Yarrell). The abdominal parietes, and those of the œsophageal dilatation forming the air-bag, are laid open to show the smooth internal surface of the air-bag; the anterior opening into the first œsophagus, and the valvular passage to the second œsophagus."

Pennant's fish measured one foot seven inches in length; the belly when distended one foot; the whole circumference when in that state, two feet six inches. The form of the body is usually oblong; but when alarmed the fish assumes the shape which has been already referred to. The mouth is small; the irides white, tinged with red; the back from head to tail almost straight, or at least very slightly elevated; there are no ventral fins; the dorsal fin is placed far back opposite the anal fin.

The fin-ray formula is,

D. 11: P. 14: A. 10: C. 6.—*Donovan.*
D. 12: P. 14: A. 12: C. 7.—*Sargint.*

The back is of a rich blue colour; the belly and sides silvery white, studded over with straight spines arising from the centre of four rays; the fins and tail brown. The spines in Pennant's representation of this fish are not so thickly set as in the figure of Mr. Donovan, or in the drawing by Dr. Boase; but the space over which they are spread is alike in all three,—that is, bounded superiorly by the lower jaw and the base of the pectoral fin, and posteriorly by the anal aperture.

Mr. Sargint's specimen, mentioned above, was cast ashore after a smart north-easterly gale, and was dead when picked up. Its total length was 21 inches, and its colour most brilliant ultra-marine blue on the back,

the irides were grey with white spots, and a double row of dark spots extended from the snout backwards over the eye, and then curved down in front of the gill-opening. The spines on the ventral pouch were white, and had each four roots; they extended from beneath the mandible to the vent.—*Zoologist*, 3848.

PENNANT'S CROP-FISH.

THE SHORT SUN-FISH, OR MOLEBUT.

HEULBYSG BIRR, *Wales.*

Orthagoriscus mola,	SCHNEIDER.	CUVIER, Règne An. t. ii. p. 369.
,,	*Rondeletii, Sunfish,*	WILLUGHBY, p. 151, I. 26.
Tetraödon mola,	*Short Tetrodon,*	PENN. Brit. Zool. iii. p. 172, pl. 22.
,, ,,	*Sun-fish,*	DONOV. Brit. Fish. pl. 25.
Orthagoriscus mola,	*Molebut,*	FLEM. Brit. An. p. 175, sp. 32.

ORTHAGORISCUS.* *Generic Characters.*—Compressed, incapable of inflation, with the tail so short and high as to give the fish the appearance of having its hinder parts sliced off. Dorsal and anal high and pointed, joined

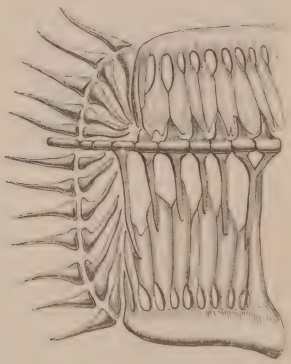
* The Greek word *Orthagoriscus* is also spelt *Orthragoriscus*, and means "little pig."

to the caudal. No air-bladder. Stomach small, entered directly by the bile-duct. Jaws of *Diodon*. The base of the muscular arterial bulb provided with four semilunar valves. Constituting the *Orthagoriscini*, a sub-family of the *Diodontidæ*.

The Sun-fish, or Molebut, as this species has been called by Dr. Fleming, though occurring but occasionally, may be said to have been taken from John o' Groats' to the Land's End.

Sir Andrew Balfour and Sir Robert Sibbald have noticed the species in Scotland, and Dr. Neill mentions three examples that were got in the Frith of Forth. Edward Jesse, Esq. kindly sent a memorandum of one caught on the coast of Northumberland in October 1834. Dawson Turner, Esq. and Mr. Paget have known it to be taken at Yarmouth. Specimens occasionally find their way to the London market. Colonel Montagu, in his MS. notes, mentions one that was caught at Salcombe in July 1799, of large size, and weighing three hundred pounds. In the fifth volume of Mr. Loudon's Magazine of Natural History, page 315, there is a record of one that was taken at Plymouth; and Dr. Borlase, Willughby, and Mr. Couch, have seen and described examples that were procured on the Cornish coast. Still farther to the westward and northward, the Sun-fish has been captured in the Bristol Channel, and one was caught in the summer of 1835 at Tenby. On the Irish coast, it has been taken at Londonderry: and Dr. Arthur Jacob, Professor of Anatomy in the Royal College of Surgeons in Dublin, drew up an account of a specimen picked up in the month of August 1826, between the south-west coast of England and Dublin Bay. This paper was inserted in the Dublin Philosophical Journal for November 1826, and is the best account of the fish that has hitherto been published.

The Short Sun-fish is, in fact, scarcely a rare fish in our seas. Sailors often observe it in fine weather in the chops of the Channel, sleeping on the surface, when it can be approached in a boat with moderate caution. In the second edition of this work various instances of its capture in the British seas subsequent to the appearance of the first edition are mentioned, and, among others, that of one in the Frith of Forth, which, coming into the possession of Dr. Goodsir, was carefully anatomized by him, and many parts of its structure described in the Edinburgh New Philosophical Journal.



This woodcut of the hinder part of the skeleton is reduced from a figure given in that paper. Since the date of the second edition of British Fishes upwards of a dozen instances of the capture of this species on the coasts of Great Britain, Ireland, and the Channel Islands have been recorded in the pages of the Zoologist. The

largest of them was taken at Poole, and was only three inches short of eight feet in length. Few years pass without one or more examples of the species being brought into Portsmouth Harbour, and there are perfect skeletons of it in Haslar Museum.

When observed in our seas, the Sun-fishes have generally appeared as though they were dead or dying, and floating along on one side, presenting the broad surface of the other side to view. Dr. Neill says, of one that was brought to him, "The fishermen informed him, that when they observed it, it was swimming along sideways, with its back-fin frequently above water. It seemed to be a stupid, dull fish: it made little or no attempt to escape, but allowed one of the sailors to put his hands under it, and lift it fairly into the boat. The Sun-fish has been generally mentioned as remarkable for its phosphorescence; but this specimen did not exhibit that phenomenon so distinctly as a Haddock or a Herring." Pennant repeats Brünnich's account, that between Antibes and Genoa he saw one of this species lying asleep on the surface of the water, when a sailor jumped overboard and caught it.

Mr. Couch says the Short Sun-fish is migratory, keeping probably at the bottom, and feeding on sea-weeds at ordinary times; but in calm weather it mounts to the surface, and lies asleep, with its head and even its eyes above the water, floating with the tide. Mr. Couch has known the Sun-fish make powerful but awkward efforts to escape when attacked, bending and directing its motions in various ways.

The representation at the head of this subject is from an adult fish, which was cast ashore at Scarborough and is preserved in the Museum there. It measured, from the point of the nose to the end of the caudal fin, three

feet five inches, the depth of body alone being one foot nine inches; the height of the dorsal fin was one foot five inches, and the whole vertical height, including the dorsal and anal fins, was four feet six inches; the weight one hundred and twenty pounds. An Ilfracombe specimen taken in 1839, measured, from the point of the nose to the end of the caudal fin, five feet one inch; its depth of body alone was three feet one inch, and the height of the dorsal fin one foot ten inches; across the body, including dorsal and anal fins, the height was six feet nine inches and the weight as estimated was four hundred pounds: from the point of the nose to the eye measured eleven inches; the diameter of the orbit was two inches and a quarter: the irides were greyish-brown,

YOUNG MOLEBUT.

with a bright straw-coloured ring near the pupil; the pectoral fin was lodged in a depression and the basal attachment of each fin was thick and fleshy. In these adult fish the skin is generally of a dingy greyish-brown, the colour becoming lighter towards the belly; its surface is rough, and its texture very hard and thick. The adults are also longer in the body, compared to their depth, than young fish; the latter, inclusive of the caudal fin, being almost round.

The second figure of this fish here given, and the description, are taken from a young fish preserved in the Museum of the Zoological Society. It measures but fourteen inches from the point of the nose to the end of the body; the breadth of the caudal fin is two inches; the depth of the body eleven inches and a half: the length of the dorsal fin eight inches; that of the anal fin, seven inches and a half: the connecting membrane of the fins is rather thick. The mouth is small; the gill-opening is just in advance of the pectoral fin, and is small and oval; the vent is situated close before the anal fin; and the caudal, which occupies the whole space between the anal and dorsal fins, is attached to the trunk of the body as if by a long vertical hinge: the surface of the skin in this young specimen is but slightly rough, and is somewhat wrinkled. The colour of the upper part of the body is dusky bluish-grey, of the lower part olive-brown. The fin-rays in number are—

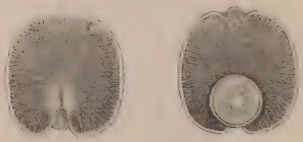
D. 15: P. 11: A. 15: C. 13.

Mr. Couch prepared the mandible of a Sun-fish of considerable size. Its dental margin, for three inches round the front, is covered to the edge by a narrow band of enamel and is undivided: on the inside, near the centre, there are various dull pearl-like teeth; some of them thin

and flat, with a cutting edge, and behind them others, more cylindrical, short, and rather pointed.

The Sun-fish is often infested with one or more kinds of parasites adhering to various parts of the body. Dr. Storer found one species attached to the branchiæ; the Ilfracombe fish had several parasites adhering to the soft parts about the anal aperture; and upon the external surface of the head of the example of the Sun-fish taken at Tenby, there were attached about twenty examples of *Tristoma coccineum*. Two of these having been procured by H. E. Strickland, Esq., of Cracombe House, Gloucestershire, the representations in the vignette below of the upper and under surface were etched of the natural size. For an account of two species of these very rare parasitic animals, see the *Synopsis Entozoorum* of Rudolphi, page 427.

TRISTOMA COCCINEUM.



THE OBLONG SUN-FISH.

HEULBYSG, *Wales.*

Orthagoriscus oblongus, Schneider. Cuvier, Règne An. t. ii. p. 370.
Tetraödon truncatus, *Oblong Tetrodon,* Penn. Brit. Zool. iii. pl. 22.
,, ,, *Truncated Sun-fish,* Donov. Brit. Fish. pl. 41.
Orthagoriscus truncatus, ,, ,, Flem. Brit. An. p. 175.

The Oblong Sun-fish was once considered by some naturalists to be of the same species with that last described, its greater length in proportion to its depth being thought to be merely the consequence of greater age. A better acquaintance with the fish has settled the question, and the figures of the two species that were presented in the second edition of British Fishes are conclusive evidences of their distinctness.

The Oblong Sun-fish seems to be much more rare than that last figured. Dr. Borlase appears to be the first English writer who saw and described it. In his Natural History of Cornwall he speaks of it under the title of the Sun-fish from Mount's Bay, after having described

and figured the Short Sun-fish, and mentions that a specimen of this second species was taken at Plymouth in 1734 that weighed five hundred pounds.

Mr. Donovan, in his Natural History of British Fishes, says,—"We have seen the dried skin of this species, the animal of which, when living, weighed between two and three hundred pounds. Our figure is taken from a small specimen, obtained in a recent state, in one of our fishing excursions on the Bristol Channel. This fish subsists on worms of the testaceous and other tribes, small crabs, &c., fragments of these being found on dissection in the stomach."

Since the publication of the first edition of this work, a fish of this rare species wandered into the loch of the newly-made canal at a short distance west of Fowey, and was carefully skinned and preserved, to be presented to the Royal Cornwall Museum. A description by Mr. Couch, published in the sixth volume of the Annals of Natural History, is as follows:—"The length twenty-two inches; depth of body over the side eleven inches and a half; from the snout to the eye two inches and three-quarters; to the origin of the pectoral fin eight inches and a half; length of pectoral fin four inches and a half; width of caudal fin one inch and a half; dorsal and anal fins each about six inches long."

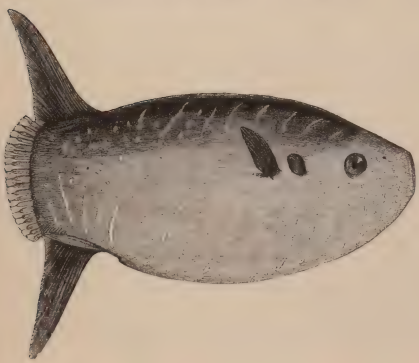
More lately, the Zoologist (3487) has announced that one example was obtained in Orkney, and another (3847) at Burghead, in the Moray Frith, which measured three feet; a third was washed on the shore of Swansea Bay, in October 1842, and is now preserved in the Museum of the Royal Institution of South Wales. It was a young male, which measured twenty-five inches and a half in length, the body being twelve inches and a half deep; and the height between the tips of the dorsal and anal fins

was twenty-one inches and a half. When picked up, the specimen was quite fresh; the eye and silvery coating of the belly were particularly brilliant, and the wavy stripes and spots on the skin were well defined. The eyes were brilliant brown and silver, the pupils dark blue; the back was dusky brown, dappled with grey and scattered silvery spots; the sides and belly had the appearance of being covered with silver-leaf, marked elegantly with a few wavy streaks of greyish-brown. The mouth was cylindrical, and an inch in diameter, the gill-opening semilunar, and close to the upper base of the pectoral fin; the nostrils, which were very minute, were situated halfway between the eyes and the mouth. The stomach contained a few shells and some decomposed matter.—*Newspaper slip.*

Fin-ray formula:—

D. 16: A. 16: P. 14: C. 17.—*South Wales sp.*
D. 12: A. 15: P. 14: C. 17.—*Donovan.*

YOUNG HEULBYSG, DRAWN BY A. F. ROLFE, ESQ.



THE COMMON BRITISH STURGEON.

Acipenser Thompsoni, Ball., Thompson's Nat. Hist. of Ireland, iii. 245.
,, *sturio, Common Sturgeon*, Penn. Brit. Zool. iii. 164, pl. 22.
,, ,, ,, ,, Donov. Brit. Fish. pl. 55.
,, ,, ,, ,, Jenyns, Man. 493.
,, ,, *Sturgeon*, Flem. Brit. Anim. 173.

Acipenseridæ. *Family Characters.*—Form elongated, pentagonal; the angles of the body formed by the crests of five longitudinal rows of bony shields; mouth on the ventral aspect, protractile, toothless; no branchiostegals; internal skeleton cartilaginous, except the basal cephalic plate of bone, which extends backwards under the first five dorsal vertebræ; vertical fins supported anteriorly by short bony rays; a long spiral intestinal valve; pancreas glandular.

Acipenser. *Generic Characters.*—Snout tapering, beak-shaped, with four barbels depending from its ventral surface before the mouth; an accessory gill, and, at the upper border of the gill-cover, a spout-hole; trunk of the tail not flattened.—*Heckel.*

The Sturgeons are Ganoid fishes of a lengthened shape, having a cartilaginous skeleton, and the protractile mouth situated under the eyes on the ventral surface considerably behind the tip of the snout. The jaws are much more protractile than those of a Shark, and consist of the premaxillaries going round the upper or anterior border of the mouth, with small maxillaries articulated to them laterally and connected also to the palatines. The mandible is formed principally of a pair of bony limbs, united to each other at the symphysis, ending late-

rally in a joint furnished with a trochlear cartilage, and moving on the wing-like process of each palatine. A thick fleshy lip, sometimes lobed, covers the premaxillaries; but the mandibular lip is deficient in some groups of species, except at the corners of the mouth; and in other groups the posterior lip crosses the orifice, either in form of a continuous soft roll, or with a mesial depression, or even a mesial interspace. The fulness of the lips, in conjunction with the forms of the dorsal crests and a few other characters, have been made to serve for grouping the species. The gills, as in the osseous fishes, consist of five movable arches, and are comb-like, with free tips: a pectinated accessory gill also adheres to the inner surface of the gill-cover, and there is a small spout-hole close behind and above it.

Of the five rows of bony shields on the body, one protects the ridge of the back from the occiput to the dorsal fin; a lateral row extends on each flank from the shoulder to the caudal fin; and a row on each side of the belly ends at the ventrals. Each dorsal shield is more or less distinctly keeled by an acute longitudinal crest, whose apex, in some groups of species, overhangs the posterior edge of the shield, but in other groups is central, the plate sloping off from it both before and behind. The skin intervening between the rows of shields varies also in character, being naked and smooth, or studded with bony grains, either of a granular form, or star-shaped, or with acute points or even hooks. In *Ac. Güldenstädii* of Brandt, which is the *Ac. sturio* of Pallas, the skin of the breast between the coracoid shields is set with elevated star-like or roundish and denticulated ossicles; while in *Ac. nasus* of Heckel the same region is closely covered with flat ganoid scales, like those of *Lepidosteus*. In *Ac. schypa* of Güldenstädt the same part shows stellate ossicles,

many of which emit prickles. The *Schypa* is var. β and γ of the *Sturio* of Pallas, who obtained it in the Wolga and Obi.

Age changes the form and size of the body-shields of the Sturgeons, their crests becoming lower and blunter, and their disks smaller, so that in aged fish the sharply-pentagonal form of the body is lost, and the ventral shields often wholly disappear.

The fins, seven in number, are sustained by crowded jointed, and generally flexible rays, finely serrated on the edges; the short graduated rays in front of the dorsal and anal are more or less bony. The anal is situated under the posterior part of the dorsal, which is itself placed far back. A stout, tall, bony first ray supports the pectoral fin.

The skull is cartilaginous throughout, but is supported beneath by an osseous occipito-sphenoidal plate, which extends posteriorly under five cervical vertebræ, and is prolonged anteriorly into a slender vomerine and ethmoidal process; protection is afforded to the skull above by a vaulted crust of ganoid scales or shields, which have received names from Kittary,* Fitzinger, and Heckel† and others, accordant with the regions that they cover. ‡ In the views of the upper surface of the head introduced in the subsequent pages, the posterior mesial shield is the first of the dorsal series; anterior to it is the single occipital shield also occupying a mesial place; and whose anterior process enters some way between the coronal or parietal shields which form a pair and come in contact

* Dr. Modeste Kittary: Bull. de la Soc. Imp. des Natur. de Moscov. 1850.

† Annalen der Wien. Erster Band.

‡ Professor Owen observes that the attempt to ascertain the homologies of these cranial shields with the true epicranial bones of osseous fishes is difficult and unsatisfactory.

with each other for a part of their length; before the coronals and between the eyes lie the frontal shields forming another pair; in the Frith of Forth Narrow-nosed Sturgeon the frontals are wholly separated by one or more interfrontal plates; the postfrontal and prefrontal shields are exterior to the main frontals in the positions that their names indicate; laterally with respect to the coronals lie the temporal shields, often coalescent with a squamosal piece; and behind them occupying the posterior lateral angles of the head, and protecting on each side a styloid process of the cartilaginous skull (which Owen terms a representation of the par-occipital, but which Kittary calls the mastoid), lies a shield that articulates with the first dorsal, the occipital, the squamosal, and the suprascapular: the last-named shield being the first of the humeral chain that descends behind the gill-opening, heads the lateral series of body-shields, all of which partake of its scalene form; the chevron-shaped humeral shield gives support to the bony ray of the pectoral; and the coracoid, the largest piece of the humeral chain, has wholly a ventral aspect, its crest being on a line with the crests of the ventral body-shields; the suprascapular, opercular, and such cranial shields as have a lateral aspect, are represented in the profiles of the head.

The arterial bulb of the Sturgeons is furnished with two rows of valves at its commencement, and with one row at its termination. The swim-bladder is very large, and communicates with the gullet by a wide hole. In the glandular conglomeration of their pancreatic cæca the Sturgeons resemble the Sharks.

Heckel and Kner* divide the genus into six groups, three of which, viz. the *Lionisci*, *Acipenserini*, and *Helopes*, have the dorsal shields highest at their posterior edges, and the

* Süssw. Fische der Östreich. Mon. 1858.

two first-named have, moreover, fringed barbels, characters which have been attributed to no British Sturgeon. In the other three groups, *Antacei*, *Sturiones*, and *Husones*, the ridges of the dorsal shields are pointed in the middle, and slope down anteriorly and posteriorly. These groups are further characterized as follows:—4. *Antacei*, having simple and not fringed barbels, a rudimentary mandibular lip, the skin between the rows of body-shields studded with stellate ossicles, and the snout short and broad. 5. *Sturiones*, having a swollen posterior lip, contracted in the middle, simple barbels, and the skin between the rows of body-shields granulated by blunt ossicles. 6. *Husones*, having the mandibular lip divided in the middle; flat, tape-like barbels, and the skin roughened by pointed ossicles. The species are distinguished from each other by the relative positions of the osseous centres of their principal cranial shields. With respect to the value for this purpose of the form of the shields, Dr. Ball says:—"I have collected many specimens, and I do not think that the broadness or sharpness of the nose is a specific distinction, as no two of my specimens can be said to agree in the shape of that member, nor in the arrangement of the scales on it and on the head. A classification of the variations of my numerous examples will reduce the British *Sturio*, *Thompsoni* and *latirostris* to a single species." Mr. Thompson also observes that "the precise form of the bony plates on the head is of no value as a specific character, neither is the breadth of the snout." These opinions of the Irish naturalists are shared by several English ichthyologists, and the subject requires to be worked out by an investigator who has access to a sufficient number of examples from various British localities, and an opportunity of comparing them with specimens collected from the Continental rivers.

Bloch's figure is worthless from the want of correct details.

Sturgeons named, evidently from their size, *Stör*, *Storje*, *Stoer*, and *Storjer*, by the Scandinavians, inhabit the Baltic, the German Ocean, the English and Irish Channels, and the Mediterranean, Black Sea, Caspian, and Baikal. They abound also in the waters of North America which fall into the Atlantic and Pacific, but they do not appear to frequent rivers which flow into the icy seas. They feed at the bottom, in deep water, beyond the ordinary reach of sea-nets, and are therefore very rarely taken, except in friths, estuaries, or rivers, which they enter for the purpose of spawning. They are more frequently captured in the Scottish waters than on the southern coasts of England, and have been taken, according to Thompson, in the Irish counties of Cork, Derry, Kilkenny, Wexford, Dublin, Down, and Antrim. Examples are by no means uncommon in the fishmongers' shops of London, Edinburgh, Glasgow, Dublin, and other large towns, a few coming into the hands of the principal dealers every season. One caught in a stake-net near Findhorn in Scotland in July 1833, measured eight feet six inches in length, and weighed two hundred and three pounds. Pennant records the capture of one in the Esk which weighed four hundred and sixty pounds; and a head prepared by Mr. Stirling of the Anatomical Museum of the University of Edinburgh, was cut from a Sturgeon caught near Alloa, said to weigh, when entire, fifty stones, or seven hundred pounds; its length was nine feet.

The *débris* of crustaceans and half-digested pieces of fish, mixed with decaying vegetable matters and mud, have been found in the stomachs of Sturgeons, and their food

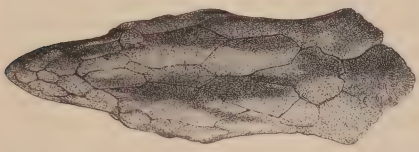
is probably any soft animal or vegetable organisms that they find at the bottom. The flesh of the Sturgeon, like that of most cartilaginous fishes, is more firm and compact than that of osseous fishes; it generally contains much yellow fat, and is well-flavoured, easy of digestion, and very nutritious. Stewed with rich gravy, it forms a dish in high request for the table. When luxury was at its height in Imperial Rome, a Sturgeon was, according to Athenæus, the most honoured *entrée* in sumptuous repasts; and Pliny tells us that it was crowned with flowers, and the slaves who bore it into the triclinium were also garlanded. Ovid calls it noble, either because of its costliness or of its excellence.

Tuque peregrinis Acipenser nobilis undis.

At a later period the price of a Sturgeon had fallen in Rome to four scudi, when a competition among the purveyors of the Catholic dignitaries assembled to elect a pope, in succession to Paul, produced an instantaneous rise in the market, and Cardinal Gualtheri had to pay seventy scudi for his Sturgeon. (*Richter*, Ichth.) In the time of our first Henry, the Sturgeon was reserved for the king's table, and even in the present day, when one is caught in the Thames within the jurisdiction of the Lord Mayor, it is called a Royal Fish, implying that it ought to be sent to the Queen. In Russia and other regions where Sturgeons abound, the roe dried and pressed forms the *Caviare* of commerce; and the swim-bladder treated in a particular manner furnishes high-priced isinglass.

The editor of the present edition of British Fishes has not had the advantage of personally inspecting the specimens that Mr. Yarrell had before him when he wrote his account of the Common Sturgeon, but he has seen

portions of eight specimens caught in the Frith of Forth, and as such of these as have their cranial plates present a near agreement with each other in external characters, and are evidently of one species, he has drawn up an account of that species in considerable detail, adopting for it the specific appellation of *Thompsoni*, suggested by Dr. Ball. It differs in several important characters from the *Ac. sturio* of Heckel and Kner. These Frith of Forth examples agree generally with a pencil sketch sent to Mr. Yarrell by Jonathan Couch, Esq., of the cranial shields of a Sturgeon caught at Lamorna in Cornwall, in May 1851. The species, therefore, has an extensive range along the British coasts, and may be the one to which the not very appropriate name of "Sharp-nosed" has been usually applied by English ichthyologists, though a more comprehensive comparison is needed to establish that as a fact.



Description of a Sturgeon caught in the *Frith of Forth*, and preserved in the Museum of the University of Edinburgh. Length nearly six feet. The barbels are rather nearer to the tip of the snout than to the mouth, and

when laid back do not reach the latter. They are tapering and roundish, but in the dry state show a furrow as if they were composed of two binate cartilaginous rays. Other Frith of Forth specimens do not exhibit this furrow. The lips, having shrunk so that their true form cannot be ascertained, are not described. Shields or bucklers, closely connected by suture, cover the whole dorsal aspect of the head. They are deeply pitted, the pits being only partially disposed in rows so as to form radiating furrows. These well-defined depressions are separated by thin walls, which are crenulated, but do not rise above the general level, so that the character of the surface is not granular. The osseous centres of most of these shields may be made out, but they do not rise into acute crests as in the young fish. Certain lines or ledges are visible rather by their smoothness than by their elevation, and the most remarkable of them present the profile of an obelisk whose apex is in the centre of the occipital shield, whence short lines deflect on each side to the osseous centres of the coronals. Lines proceeding from thence to the centres of the frontals form the sides of the obelisk. Other less conspicuous lines radiate from the same centres of the frontals, namely, backwards over the temporals, and forwards towards the nasal regions, with a convergence coincident with the narrowing of the snout. The polygonal occipital shield receives the anterior point of the first dorsal shield into a sharp mesial notch, and emits anteriorly a salient acute process that enters between the coronals for nearly one-half of their length, these plates coming in contact with each other for only about a third of their length, and having the point of an interfrontal plate insinuated between their anterior ends. This oblong interfrontal, and two other intercalary pieces, larger, but otherwise similar to the polygonal shields which

closely cover the whole upper surface of the snout, separate the frontals wholly from each other. The osseous centres of the temporal shields are somewhat nearer to the tip of the snout than those of the coronals are. On the left side of the specimen a small squamosal interposes between the temporal and mastoid shield, but on the other side this piece is confluent with the temporal. A moderate inclination of the surfaces of the coronals towards the mesial line makes a longitudinal furrow, which disappears anteriorly, the interfrontal plates being nearly flat, and the snout flatly convex transversely. Much of the gill-flap is occupied by the large opercular shield, which is marked by pits and furrows, with thin intervening crenated walls distinctly radiating from a point near the posterior edge of the plate. This shield being visible from above merely in profile is not represented in the cut. Behind and beneath the eye there is a rough rectangular chevron which, in form and position, represents the preoperculum of osseous fishes. On the under surface of the snout a raised ledge, narrow at the barbels and widening gradually in running forwards, as in the *Ac. sturio* of Heckel, is covered either by a single slightly-rough plate, or by several coalescent ones. The humeral plate is deeply pitted, and the coracoid is marked by distinctly-radiating furrows and pits.

The body-shields are radiately furrowed and pitted, and have thin longitudinal crests. Eleven saddle-formed shields occupy the ridge of the back before the dorsal fin, the fourth or fifth of the series being the largest, and the ridges of all highest in the middle. The scalene lateral shields, lying between the suprascapular and caudal fin, are thirty in number. In other specimens their number varies from twenty-nine to thirty-two, there being generally more on one side of the fish than on the

other. Heckel and Kner describe the middle lateral shields of their *Ac. sturio* as having a styloid process which proceeds forwards beneath the skin to the preceding shield, and is said to be characteristic of the species; but in the Frith of Forth Sturgeons no such process exists in any one of the whole lateral series, there being merely a notch with a flexible tube, corresponding to the lateral line of osseous fishes. There is, however, a strong and distinct smooth styloid process from the front of all the ventral shields of the Frith of Forth specimens, except the first two of the series. These ventral shields are also unequal in number, on the two sides of the fish, and vary in the specimens from nine to eleven.

The skin between the dorsal and lateral rows of shields is pretty thickly studded with star-like ossicles, intermingled with much more minute angular grains. A cluster of these ossicles is represented under the preceding wood-cut. A pair of small shields intervenes between the dorsal series and the dorsal fin, and on each side of the base of this fin there are about ten star-like ossicles larger than the others. Below the lateral shields the distinctly-stellate ossicles become fewer, and the irregular, crested grains more numerous. Between the limbs of the coracoids, and more especially a little further back below the pectorals, the skin is made rough by extremely irregular ossicles, apparently formed by the confluence of several minute angular grains and acute points, and this roughness continues onwards to the vent. The integument before the opercular shield is studded with small roundish and irregular plates, all with radiating lines from flat centres, and small plates of more oblong but various outlines roughen the surface between the mouth and the coracoids.

The dorsal fin is supported by forty-one rays, the first

being a flat, longitudinally oval plate resembling the dorsal shields in size and texture, but having a small posterior peak, which rises as the first of the rays. About six stumps, seemingly bony and gradually increasing in height, follow it, and are incumbent on each other and on the flexible rays. Behind the dorsal two heart-shaped plates follow one another on the ridge of the tail. The anal, which in this specimen has been injured posteriorly, consists in others of twenty-five rays, the first being very short and incumbent, and in fact the peak of an oblong flat plate, as in the dorsal. Between this plate or fulcrum and the vent there are three pairs of small shields. An upper low caudal fin is composed of a long strap-shaped rough plate with a posterior peak, and of eighteen or nineteen firm, slender, jointless rays lying closely tiled on one another. Underneath these inflexible rays there is a triangular lateral space on each side, which is densely covered by rough, keeled, bony eminences. The under portion and main part of the caudal is lobed anteriorly, and contains numerous jointed rays. In young individuals the anterior under lobe is said not to be developed. The pectoral contains thirty-eight rays, which are prickly on the edges, and the first one is stout and bony, seemingly formed by the coalescence of about ten rays, whose number is shown by the prickly ridges which rib its surface.

Dr. James McBain, of Leith, possesses the head of a Sturgeon that was caught near Stirling, in which the cranial plates correspond almost exactly with those of the specimen described above, except that the squamosals on both sides are coalescent with the mastoidal shields. In this preparation the thin vertical plate of bone which descends from the mastoidal shield into the cranial cartilage is well shown. Dr. McBain's fish seems to have

been nearly one-third larger than the one in the Edinburgh University Museum described above.

Another perfect specimen of smaller size being only three feet eight inches and a half long, preserved in the Museum of the Free Kirk College of Edinburgh, presents also a close similarity in the cranial plates to the two preceding, but the squamosals are both united to the temporals, and the mastoids have consequently smaller disks. In this younger fish the pits and furrows in the shields are deeper and more distinctly radiated from osseous centres. The crests of the dorsal shields are higher, and the styloid anterior processes of the ventral shields are very distinctly perceptible through the skin. The ossicles which stud the skin of the body are more generally and perfectly star-like, more of the rays being acute. There are twenty-nine lateral shields on one side, and thirty-two on the other, and the ventral shields on the right side number ten, but there are only nine on the left side. The fin-rays are—

D. 41 : A. 25 : P. 1 | 37 : V. 27 or 28.

The osseous centres of the temporals are equidistant from the tip of the snout with those of the coronals, instead of being a little nearer, as in the other two examples, the difference being probably due to the squamosals having in this example a common centre with the temporals. The snout is also narrower, and the shields covering it are closely pressed together so as to seem confluent. This probably arises from the cartilage not having been so fully cleared out in preparation, and shrinking much in drying. To this cause also may perhaps be attributed the very slender snouts of some of the younger Sturgeons preserved in English Museums. The exact place of capture of this individual is not mentioned on the

label attached to it, but it has a special interest as belonging to the Museum formed by the late Professor Fleming, and, therefore, representing the *Acipenser sturio* of his British Animals.

In the Museum of the College of Surgeons of Edinburgh, there is a stuffed Sturgeon in excellent order, which measures six feet and a half in length, and does not differ materially in the form and arrangement of the cranial shields from that of the University Museum. The shields both on the head and body are, however, more deeply pitted and furrowed, their radiation is more complete, and the intervening walls of the furrows are more granulated; more of the imbedded ossicles also are star-shaped. There are eleven dorsal shields; thirty-two lateral ones on the left side, thirty on the right side; and the ventral shields are ten and eleven on the right and left sides respectively. The label to this Sturgeon does not indicate its place of capture.

In the Anatomical Museum of Edinburgh University, there are preparations of several Sturgeons caught near Alloa, and in other parts of the Frith of Forth, made to exhibit the structure of the cartilaginous cranium and other internal parts. One of these shows that the occipital spine of the cartilaginous cranium is acute, and that it does not project so far back as the mastoid or par-occipital processes which are also acute. Kittary's figure of the cartilaginous cranium of his *Ac. sturio*, an inhabitant of the Caspian, represents the occiput and snout as being both widely rounded (*l. c.* Pl. vi. f. 5).

Taking Heckel and Kner as the best authorities for the continental *Ac. sturio*, and more especially for the fish of that name in the Danube, we find that, though their figures and description present many characters in common with the Frith of Forth Sturgeon, there are

some points of difference which prevent us from pronouncing on their identity without further investigation. The specific marks they assign to their *sturio* are, "premaxillary lip with an incurvature, short barbels, osseous centres of the temporals nearer to the point of the snout than those of the coronals; the process of the occipital shield that interposes between the ends of the coronals broad and chisel-shaped or truncated, and the coracoid bucklers roughly granulated, not rayed." Supposing these characters to be constant, the last-mentioned one and the truncation of the salient process of the occipital do not correspond with those parts in the British fish. The skin also of the Austrian *Sturio* is described as being studded with rough, blunt ossicles, mostly uniform in size, being merely a little larger near the head, but nowhere either radiated or stellate. In the form of the dermal ossicles the Frith of Forth Sturgeon agrees with the *Antacei* rather than with the *Sturiones*, but not with any of the six *Antacei* figured in Heckel and Kner's book. The inflexion of the upper lip belongs to all these *Antacei* except *A. schypa*.

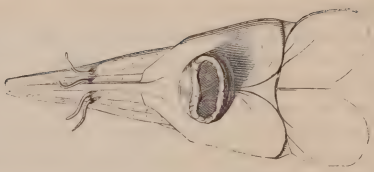
Respecting the young, the Austrian authors so often referred to say that *Ac. sturio*, when not exceeding ten inches in length, has a stiletto-shaped snout bent upwards, the occipital enters further between the coronals; in place of the interfrontal shields there is a fontenelle, and the under anterior caudal lobe is not developed. In the Museum of the Free Kirk College at Edinburgh there is a Sturgeon, about eighteen inches long, which may probably be the young of the Frith of Forth species, described at such length in the preceding pages. It has a slender, elongated snout, evidently greatly shrunk in drying, but the arrangement of the cranial shields has much resemblance to that which exists in the older fish. The inter-

frontal plate is composed of six pieces, and the squamosals are not united to either the mastoids or temporals. The reason for entertaining a doubt of the identity of the species is the difference of character of the surface of both cranial and body-shields. In the small specimen the roughness of the plates is produced by round grains of various sizes disposed in radiating lines with furrows between, while in the old the crenulated edges of the thin walls that bound the depressions do not rise above the general level. The osseous centres form in the young thin crests, which on the dorsal shields have a hooked apex. A continuous crest runs from the centre of the temporal along the side of the head to that of the mastoid; and owing to the greater elevation of the centres of the coronals the mesial trough is deeper than in the larger fish, but the lines which in the latter form the profile of an obelisk are not evident. The suprascapular is pitted with radiating grooves towards its edges, and the coracoid is also decidedly radiated. The skin between the rows of body-shields is studded with roundish, irregular, very small osseous grains, the larger ones being radiated on the edges. In the recent state this radiation would be concealed by the epidermis. The barbels are short, tapering, and more remote from the tip of the snout than in larger fish. An under caudal lobe is already formed. The body-shields number fourteen on the dorsal row; thirty-eight on the right side in a line with the suprascapular, and forty on the left side; eleven ventral ones on the right side, and ten on the left. The fin-rays are—

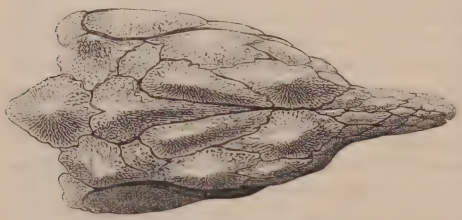
D. 37 : V. 27 : A. 26.

The osseous centres of the coronals and temporals are equidistant from the tip of the snout.

The following wood-cut, reproduced from the first



edition of British Fishes, resembles the young Sturgeon of the Free Kirk Museum in the middle ledge of the ventral aspect of the snout, not being dilated gradually towards the point, as in the larger examples. The scale is too small to give a correct idea of the form of the lips, and the figure was probably taken from a small and dried specimen.



This wood-cut, which was introduced into the second edition of British Fishes, represents an arrangement of the cranial shields, differing from all the Frith of Forth examples in the want of the interfrontal plates, and in the longer tapering prolongation of the salient process of the occipital shield: the squamosals, it will be observed, are distinct pieces. The British Museum possesses a Sturgeon from Teignmouth which is four feet and three-

quarters long, and another from the Thames, both with cranial shields similar to those of the cut. The barbels are short, tapering, and a little flattened, and the ossicles in the skin are partly stellate, but mostly minute and angular, as a sketch obligingly made by Mr. Gerard shows. This gentleman also mentions that the coracoid shields are netted, grooved, and radiated, and that the cranial shields are grooved and radiated with a series of ridges connecting the centres of the principal pairs of shields. If this be not a species distinct from the Frith of Forth Sturgeon it is at least a notable variety, but to be ranked equally with it among the *Antacei*, if the form of the mandibular lip will allow, and not with the *Sturiones* of Heckel and Kner. There is still needed a good description of the recent fish in various stages of its growth. This article has been extended to an unusual length, but accuracy did not seem attainable otherwise. In the terminating vignette, which appeared in the second edition of British Fishes, the intervals between the shields and the smallness of the opercular plate denote that the original was a young fish, though it does not show the thin elevated crests of the small specimen in the Free Kirk Museum.

THE BROAD-NOSED STURGEON.

Acipenser latirostris, Broad-nosed Sturgeon, Parnell, Trans. R. S. E. xiv. pl. 4.
" " " " Parnell, Wern. Mem. vii. pl. 39.

In the papers here referred to, Dr. Parnell observes, that but one species of Sturgeon has hitherto been recorded by British Ichthyologists, but from the observations of practical fishermen, as well as his own, he adds, "I think there is little doubt that two species, at least, will in future be recognised as inhabiting the British coast. It has long been noticed by the fishermen of the Solway Frith, that two species of Sturgeon are occasionally entangled in their Salmon-nets, the one with a blunt nose, and the other with a sharp one; the latter species being the most common of the two. A fine specimen of the Blunt-nosed Sturgeon was taken in the Frith of Forth in the month of July 1835, and brought to the Edinburgh market for sale, the head of which I preserved. A few weeks after another was taken in the Tay, which differed in no respect from the former, except in sexual distinction."

"Length seven feet nine inches; weight eight stone, or one hundred and twelve pounds. The colour of the back and sides is of a light grey, with a shade of olive; the belly dirty white. The skin is rough, with a number of small angular osseous plates intermixed with very minute spicula. The first free shield on the dorsal ridge is nearly circular, and very slightly carinated; all the rest in that row are of an oval form. The snout is wide and depressed, much broader than the diameter of the mouth. On the under surface, placed nearer to the tip of the snout than to the mouth, are four cirri arranged in an irregular line. The summit of the head is rough, with the central plates beautifully radiated, and of a fibrous appearance. The position of the fins is the same as in other Sturgeons."

"This fish differs from the Common Sturgeon, in having the tip of the snout much broader than the mouth, in the keel of the dorsal plates being but slightly elevated, and having the cirri placed nearer to the tip of the snout than to the mouth. The Sturgeons are all much allied to each other; and not being able as yet to find the right synonym for the present one, I have proposed, in the mean time, the name *latirostris*, as characteristic of the species."

"In the stomach of the one from the Tay was found an entire specimen of the Sea-mouse, *Aphrodita aculeata*."

Dr. Parnell has presented the preserved head of this specimen to the Museum of the Zoological Society, and the cranial shields of one caught in the Tweed are preserved in the British Museum. This Sturgeon does not agree with any one of the nine species from the waters of the Russian empire, figured and described by Lovetski in the third volume of the Transactions of the Imperial Society of Naturalists at Moscow, nor with any of the eleven species figured in Brandt and Ratzburg's Medical

Zoology. The dorsal shields are those of the *Antacei* or *Sturiones*. In the arrangement of the cranial shields it bears a resemblance to the *Ac. Naccarii* of Bonaparte, and of Heckel and Kner, but the osseous centres of the temporals, instead of being farther from the tip of the snout, are nearer to it than those of the coronals. In the outline of the snout, as well as in the cranial shields, it approaches the *Ac. sturio* of Kittary from the Caspian.* The terminal wood-cut and the one at the head of the article are both reduced from Dr. Parnell's figures in the fourteenth volume of the Transactions of the Royal Society of Edinburgh, with the addition in the terminal vignette of a sagittal suture between the coronals, which has been omitted in the original plate. Mr. Gerard has sent a tracing of the head of a Sturgeon taken at Teignmouth, and preserved in a dried state in the British Museum, which, if the Broad-nosed Sturgeon is actually a distinct species, may be a younger example of it. The head is ten inches long. Without having seen an authentic specimen of the Broad-nosed Sturgeon, the editor does not venture to characterize the structure of the shields or dermal ossicles. Drawings of the body-shields represent them as pitted in distinct rays, and the cranial shields are also radiated in Dr. Parnell's figures.

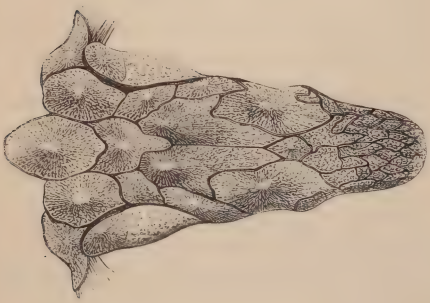
Among Mr. Yarrell's papers is the following notice. On the 9th of October 1851, a Broad-nosed Sturgeon was taken in the Exe, near Powderham. It was seven feet long, and had a dark lead-blue colour with a tinge of pinkish-grey. The dorsal plates were in number thirteen, and four small ones were placed between the dorsal and caudal fins. The lateral plates numbered thirty-two, and the ventral ones fifteen in a row; and three or four

* Bull. de la Soc. Imp. des Nat. de Moscou, 1850, pl. vii. f. 3.

existed behind the ventral fins. The barbels were half an inch nearer to the tip of the snout than to the mouth; and the width of the face at the mouth was seven inches, at the tip of the snout four.

Various imperfect accounts of new Sturgeons, or of a supposed *Ac. huso*, have appeared in periodicals, but the writers have evidently been unacquainted with the characters of the numerous species of the genus.

PARNELL'S BROAD-NOSED STURGEON.



THE NORTHERN CHIMÆRA.

KING OF THE HERRINGS.—RABBIT-FISH, *Zetland.*

Chimæra monstrosa, LINNÆUS. BLOCH, pl. 124.
,, ,, *Northern Chimæra*, PENN. Brit. Zool. iii. p. 159.
,, ,, *Sea Monster*, DONOV. Brit. Fish. pl. 111.
,, ,, *Rabbit-fish*, FLEM. Brit. An. p. 172.

CHIMÆRÆDÆ. *Family Characters.*—Interiorly five gill-apertures that communicate with a common passage, which has only one external orifice. A rudimentary operculum concealed by the skin. Upper jaw represented by the vomer, palatines and tympanals, rudimentary on the sides of the snout. Four hard bony plates above, and two below, supply the place of teeth. Males furnished with trifid claspers. Eggs large and leathery, with flat velvety borders.

CHIMÆRA. *Generic Characters.*—Snout conical. Dorsals contiguous, the second one long and low, extending to the base of the caudal, which embraces the sides of the filamentous extremity of the tail.

THE genera *Chimæra* and *Callorhynchus* constitute the order of HOLOCEPHALI, whose members have placoid granules in the integument, and cartilaginous skeletons

with merely partial and scanty bony deposits. Most of the fins have a strong spine for the first ray, and the ventrals are situated on the belly. The membrane to which the two rows of processes forming a biserial gill are attached is, in the *Holocephali*, continued beyond the points of the processes, and in this way four branchial slits are formed under the integument, with a single external gill-opening common to them all, differing in this latter respect from the Sharks, which have an external opening between each pair of gills. Though there are four branchial slits in *Chimæra*, there are but three complete biserial gills, with, however, an accessory gill of a single series attached to the inner side of the operculum, and another uniserial gill attached to the inferior pharyngeal, or fourth arch. The *Holocephali* have, moreover, two rows of three valves in the interior of the long muscular arterial stem, also a spiral valve in the intestine, and they are destitute of an air-bladder. The family contains few species, but is represented in the northern and southern hemispheres, in both oceans, and in the Mediterranean.

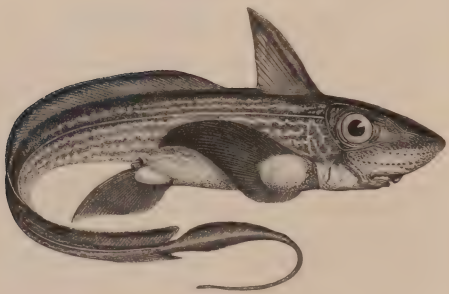
The Northern Chimæra is a fish of singular appearance and beauty. It is a native of the Northern and Mediterranean seas, seldom exceeds three feet in length, and is generally taken when it is in pursuit of shoals of Herrings, or other small roving fishes, upon which it principally subsists; though Bloch says that it feeds also on medusoids and crustaceans. Its flesh is considered to be hard and coarse. According to some authors, the Norwegians extract an oil from the liver, which they think is of singular efficacy in disorders of the eyes.

Pennant received from a gentleman a drawing of one that had been taken among the Zetland islands, and the species

was also known to Dr. Walker as an occasional visitor in that locality. Never having seen this fish, Dr. Fleming's description of a male specimen sent by L. Edmonston, Esq., from Unst, where it is termed the Rabbit-fish, is here inserted. A specimen caught in the same locality was received in 1834 by Mr. W. C. Hewitson of Newcastle, the author of a valuable work on the eggs of British Birds.

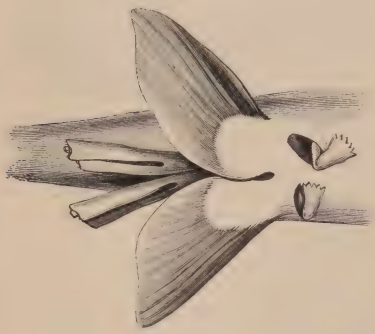
"Length nearly three feet. Body compressed. Head blunt; the snout sub-ascending, blunt. A narrow crenulated grinder on each side of the mandible, and a broad tubercular corresponding one above. Nostrils contiguous, and situated immediately over the upper lip,

FEMALE RABBIT-FISH.



each having a complicated cartilaginous valve. Branchial openings in front of the pectorals. Eyes large, lateral. On the crown (of the male), in front of the eyes, a thin

osseous plate, bent forwards, with a spinous disc at the extremity on the lower side. Lateral line connected with numerous waved anastomosing muciferous grooves on the cheeks and face. The first dorsal fin standing above the pectorals high, with a short base, and a strong spine on its anterior edge. The second dorsal, which rises immediately behind the first, is low and long, being continued to the caudal one, where it terminates suddenly. The pectorals are large and sub-triangular. Ventrals rounded; in front of each a broad recurved osseous plate, edged with recurved spines. Claspers pedunculated, divided into three linear segments; the anteal one simple, the retral ones having the opposite edges covered with numerous small reflected spines. A small anal fin opposite the extremity of the second dorsal. Caudal fin, above and below, broadest near the origin, gradually decreasing to a produced linear thread."



The appendage on the forehead is peculiar to the males only, and has given rise to the name of King-fish, applied to the species by the Norwegians; who also call it Gold and Silver Fish, in reference to its beautiful colours, which are various shades of rich brown on a shining white ground. The eyes are large and brilliant; the pupils green, the irides white.

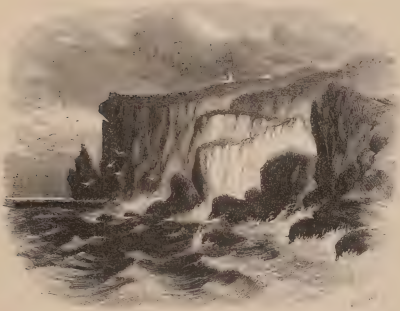
This fish was first made known by Gesner, but the designation Chimæra originated with Linnæus, and has reference to its uncommon aspect.

The cut at the commencement of this article represents a male fish, and is copied from one of two views of this fish in the fifth and sixth plates of the second volume of the Natural History Memoirs of Drontheim. The figure of the female is from the *Fauna Italica* of C. L. Bonaparte, Prince of Canino. And the immediately-preceding cut, also taken from the Memoirs of Drontheim, represents the abdominal osseous plates with their spinous serratures; the under surface of the ventral fins, and the pedunculated claspers peculiar to the males.

The Chimæra has numerous porous lines on the head and a vestige of an operculum before the single external outlet from the gills. In the bottom of the pouch from which this opening leads, the five holes corresponding to the intervals of the gills may be readily seen. These gills are not free at the tips like those of the Sturgeons, but adhere to the integuments as in the Sharks. Thus the Chimærædæ form a transition family, connected to the ordinary osseous fishes by the presence of an operculum, but more nearly related to the Sharks by general aspect, the situation of the mouth, claspers of the males, and other parts of their organization. In common with the Sturgeons and Sharks they have a spiral valve in the

distal part of the intestinal canal. The females lay large eggs, covered with a horny shell, flattened on the edges, and velvety.

MULL OF CANTYRE.



The barrier of that iron shore.—Scott.

THE SMALL-SPOTTED DOG-FISH.

MORGAY, *Scotland.*—ROBIN HUSS, *Sussex coast.*—MORGI LLEIAF, *Wales.*

Scyllium canicula,	MÜLLER und HENLE, Plagiost. p. 6.	
,, *catulus,*	*Morgay,*	FLEM. Brit. An. p. 165, sp. 8.
,, *canicula,*	*Spotted Dog-fish,*	JENYNS, Man. Brit. Vert. p. 495.
Squalus canicula,	*Spotted Shark,*	PENN. Brit. Zool. vol. iii. pl. 19. Upper fig. male; lower fig. female.
,, *catulus,*	*Lesser Spotted Shark,*	
,, ,,	,, ,, ,,	DONOV. Brit. Fish. pl. 55.

Scylliidæ. Family Characters.—Sharks having one anal and two dorsal fins, the first dorsal standing over or behind the ventrals. They have also spout-holes, but no nictitating membrane; five stigmata, with the last one over the base of the broad, unnotched pectorals; a furrow at the corner of the mouth, and a cartilage above and below: the teeth have a pointed medial cusp, and from one to four serratures on each side. The caudal is not forked, but is longitudinally extended, and either truncated or rounded at the end, without an under lobe, or with merely a trace of one, but with a notch near its end; no caudal pit. Oviparous, the eggs like those of a Skate. Intestinal valve spiral.

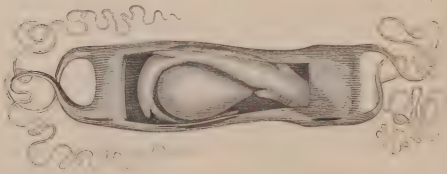
SCYLLIUM. *Generic Characters.*—First dorsal situated over the space between the ventrals and anal, the second between the anal and caudal. Spout-holes close behind the eyes. Stigmata equidistant, the last pair above the pectorals. Snout short and blunt. Nostril near the mouth, sometimes even prolonged by a furrow to the edge of the upper lip; it is so covered by the nasal lobe that only a small round opening is visible on the outer side. The nasal flap of one side is united to that on the other by a continuous middle piece. Mouth arched; teeth with a middle cusp flanked on each side by one or two small points. Dermal ossicles or scales tricuspid.

The Plagiostomes differ from the ordinary Osseous Fishes in the branchial space being divided on each side into five sacs, having no communication with each other, but each admitting the water of respiration by its proper pharyngo-branchial slit anteriorly, and emitting it posteriorly by its dermal outlet or *stigma*. The four anterior sacs are lined in front and behind with parallel projecting rows of gill-processes, adhering throughout their whole length, but the fifth sac has these processes on its proximal side only. Between the branchial sacs and the abdominal cavity, the scapular arch, consisting chiefly of the coracoid pieces, is interposed, being suspended to the fore part of the vertebral column, and not, as in osseous fishes, to the skull. The heart lies in the triangular space between the coracoid fork and the branchial sacs. The opercular apparatus is wanting, or exists merely as dermal cartilaginous rings round the stigmata, but the horns of the hyoid bone generally emit slender, divergent, cartilaginous processes, which represent the branchiostegals. In the males, behind the largely-developed ventrals, there are two peculiar appendages called claspers.

Müller and Henle divide the Plagiostomes into *Squali* or *Haifische* (Sharks), characterized by lateral stigmata, free-bordered eyelids, incomplete scapulary arch, and no cephalopterous (head-fin) cartilage; and into *Raiæ* or *Rochen* (*Rays* or *Skates*), with greatly-depressed bodies; spout-holes; stigmata on the ventral aspect, under the pectorals; eyelids adhering or absent; a complete scapulary arch, and a head-fin with a cartilaginous basis. A majority of the Sharks have spout-holes like the Rays, but these orifices are wanting in the genera *Carcharias*, *Lamia*, and *Zygæna*. The Plagiostomes generally have two rows of valves at the orifice of the arterial stem, but some genera

have four rows, and others as many as five. The *Scyllia* have two rows of three valves only at the base of the arterial system, in which they agree with *Galeus, Carcharias*, and the *Chimæræ*.

Of the true Sharks, some produce their young alive, and are called viviparous; others, like the *Scyllia*, bring forth their young enclosed in horny cases, an example of which is here introduced, a portion of one side of the case being removed to show the young fish within.



On examining adult females, the ova are observed in different stages of growth descending from the ovaries, usually in pairs, frequently one in each oviduct, becoming enclosed in the protecting covering when about to be excluded. These cases, which are frequently found on the sea-shore, and are called mermaid's purses, sailor's purses, sea-purses, &c., are oblong, of a pale yellowish horny colour, semitransparent, with an elongated tendril at each of the four corners, and are deposited by the parent Shark near the shore, in the winter months. The convoluted tendrils clinging to sea-weed or other fixed bodies prevent the cases being washed away into deep water. Two fissures, one at each end, allow the

admission of sea-water; and the young fish ultimately escapes by an opening at the square end, near which the head is situated. For a short time the young Shark continues to be nourished by the vitelline fluid contained in the capsule attached to its body by the connecting pedicle, till, having acquired the power of taking food by the mouth, the remains of the ovum are taken up within the abdomen, as in birds and some other animals.

A curious peculiarity has been observed in the young of both Sharks and Skate during a very early stage of their existence. From each of the branchial apertures, branchial filaments project externally; each filament contains a single minute reflected vessel, in which the blood is thus submitted to the action of the surrounding medium. These appendages are only temporary, and the blood of the fish is afterwards aërated by the true gills. This very interesting discovery, forcibly reminding us of the temporary external branchiæ in the young of Batrachian reptiles in the tadpole state, has been observed by Professor Owen in the Blue Shark (*Carcharias glaucus*), by Dr. John Davy in the Torpedo, and by Dr. Allen Thompson of Edinburgh in the Thornback. Cuvier had previously noticed it, and in the *Règne Animal* has referred to a figure published by Schneider of a very young Shark in this condition, for which, regarding it as the adult state of the fish, that industrious pupil of Bloch had proposed the name of *Squalus ciliaris*.

Among the Sharks, as among the truly-predacious birds, the females are larger than the males; and almost all the species have received some name resembling Beagle, Hound, Rough Hound, Smooth Hound, Dog-fish, Spotted Dog, Penny Dog, &c., probably from their

habit of following their prey, or hunting in company or packs. All the Sharks are exceedingly tenacious of life. Their skins, of very variable degrees of roughness, according to the species, are used for different purposes; in some instances by cabinet-makers, for bringing up and smoothing the surfaces of hard wood.

The two British species of Spotted Sharks appear to have been frequently confounded with each other. The terms Greater and Lesser seem sometimes to have been considered as referring to the size of the spots, and at others to the size of the fish. A slight alteration in the names, which is here suggested, will assist in defining the two species, and other decided specific distinctions will be pointed out. Both species are called *Rousette* by the French, on account of their prevailing reddish-brown colour.

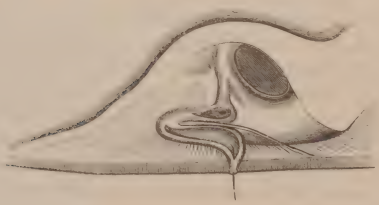
The Small-spotted Dog-fish, the subject of the present notice, is one of the most common species on our shores, particularly along the southern coast. Its station in the water is near the bottom; its food, small fish and crustaceans. It takes a bait freely, and is often caught on the fishermen's lines, but is troublesome and annoying from its numbers, and injurious to the fisheries from its voracity.

The teeth of the Sharks are very formidable weapons, generally constructed decidedly either for cutting or holding. The teeth of the Shark now under consideration are of the form here shown. The front row of teeth in both jaws is supported on the inside by other rows which come forward as the front ones are broken off or worn away.

The specimen from which the following description was taken measured eighteen inches in length. The body, from the base of the pectoral fins, where it is thickest, tapers all the way to the end of the tail. The head is flattened at the top; the eyes are large and the orbits elongated, with a distinct spout-hole behind each.

The form of the under surface of the nose, the nostrils, and upper lip, are shown in the left-hand figure of the cut; the mouth, of a horse-shoe shape, has its extreme angles directed outwards. The teeth are numerous, small, pointed, and sharp; the pectoral fins large: the five branchial apertures or stigmata on the sides of the neck are elongated vertically, the first being rather the largest, the last the smallest, and the fourth is situated over the anterior edge of the pectoral fin. The ventral fins are united almost throughout in the males, but less completely in the females, and the elongated anal aperture lies between them; in both sexes their extero-posterior borders are as oblique as the front ones. The right-hand figure of the foregoing cut shows the lozenge shape of these fins as seen from below. The first dorsal fin stands over the space between the ventral and anal fins, and in nearly the middle of the whole length of the fish; the anal fin is under the space

between the first and second dorsal fins; the posterior edge of the second dorsal fin is half-way between the commencement of the first dorsal fin and the end of the tail, and the vertebral axis of the tail is nearly in a line with the body, with a narrow elongated membranous expansion above it, and one long and one short triangular expansion below it. All the upper part of the body is marked with numerous small, dark, reddish-brown spots on a pale reddish ground; the spots on the fins being rather larger and less numerous than those on the body; the lower part of the sides and the ventral surface are yellowish-white. The skin, to the finger passed from the head towards the tail, is smooth, but in the opposite direction rough, and under a lens it is seen to be covered by minute spiculæ, with their points directed backwards.



ACOUSTIC CANALS OF A SHARK.

Being a longitudinal section copied from the Philosophical Transactions. Two parts of the auditory passage are slit open. The minute opening in the bottom of the upper part of the tube leads to the vestibule.

THE LARGE-SPOTTED DOG-FISH.

BOUNCE, *Scotland and Devonshire.*
ROCK DOG-FISH.—CI-YSGARMES, *Wales.*

Scyllium catulus, MÜLLER und HENLE, Plagiost. p. 9.
,, *stellare*, *Bounce*, FLEM. Brit. An. p. 165, sp. 7.
,, *stellaris*, *Rock Dog-fish*, JENYNS, Man. Brit. Vert. p. 496, sp. 185.

THIS Shark is at once distinguished from the species last described by its larger but less numerous spots, and by the ventral fins, which are truncated or nearly square at the end. Like the Small-spotted Dog-fish, its haunts are near the bottom, and its food similar; but it also frequents rocky ground, and has accordingly been distinguished on the Continent by the term *Rochier*.

Mr. Jenyns, in his valuable Manual of British Vertebrate Animals, has so clearly pointed out the specific distinctions of this fish, from examples obtained at Weymouth, that, in the absence of a specimen, his comparative description is, by permission, here given.

"Length from two to three feet. According to M. Blainville, this species attains to a larger size than the

last. Differs essentially from *S. canicula* in the structure of the lobes of the nostrils, and in the form of the ventrals: the former are not united as in that species, and of a smaller size, leaving the whole of the mouth and the upper lip visible: the ventrals, instead of being cut obliquely, are cut nearly square, their posterior margins meeting at a very obtuse angle; they are united or separate according to the sex, in a similar manner; the snout is rather more elongated; and, according to some authors, the tail rather shorter, giving the dorsal a more backward position; but this last character I have not noticed myself. Upper parts brownish-grey, with very little of the red tinge observable in the last species: back, flanks, and tail, sparingly marked with large spots of a deep brown or black colour: under parts whitish."

NASAL FLAPS. VENTRALS.

THE BLACK-MOUTHED DOG-FISH.

EYED DOG-FISH, *Cornwall.*

Pristiurus melanostomus, Müller und Henle, Plagiost. p. 15.
Scyllium melanostomum, *Eyed Dog Fish*, Couch, MS.

Pristiurus. *Generic Characters.*—*Scyllia*, but having a more prominent snout, and a binate row of flat-toothed scales on the upper edge of the tail forming a kind of saw. The caudal fin as in *Scyllium*, but showing a trace of an under lobe. The second dorsal stands over the hinder part of the anal. Nostril furnished with a short cuticular three-cornered flap. Eggs like those of *Scyllium*.

At the time of publishing the account of this Shark in the first edition of the British Fishes, a single example only had been obtained by Mr. Couch. Since then the communications of John Malcolm, Esq. have shown that this species is not uncommon on the west coast of Scotland; and Mr. Malcolm, very kindly, gave me one of two specimens that had been procured and sent to him from that locality. It has also been taken in the North of Ireland by Captain Portlock, from whose sketches the different subjects forming the vignette at the end were engraved. This Shark appears to be known to several authors in the North of Europe, and has been called *annulatus* by M. Nilsson in his Prodromus of the Ichthy-

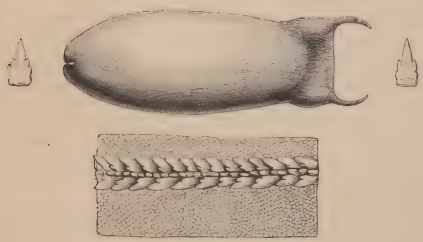
ology of Scandinavia, because of the ring-shaped disposition of the coloured markings.

The account of this species in the MS. of Mr. Couch is as follows:—

"The specimen from which my description has been taken was caught on a line by a fisherman of Polperro on the 8th February 1834. Its length was twenty-five inches and three-quarters, and seven inches round where stoutest. The head flat on the top, rather wide posteriorly; snout thin, protruded one inch and three-quarters from the anterior angle of the eye; nostrils one inch and a quarter from the snout, double, one beneath linear, the other marginal, having its hinder edge prominent, and a depression in the head immediately above it; eye rather large, oval, and close behind it a moderately-sized temporal orifice; mouth one inch and three-quarters wide; teeth numerous, small, sharp, with a small sharp process at each side of the base of each tooth; spout-holes five, open; the back somewhat elevated close behind the head; the skin rough against the grain; pectoral fins wide, much like those of the Picked Dog: the first dorsal begins at twelve inches from the snout, and behind the ventral fins; the second at sixteen inches and a half, both rather small: ventrals ten inches from the snout; anal fin four inches long, rather narrow, terminating just opposite the end of the second dorsal; extreme length of the tail seven inches: the upper lobe in a line with the body, bent down towards the termination, rounded, incised, or jagged; under lobe rather narrow in its course, expanded beneath; the upper ridge of the superior lobe has a double row of prickles pointing outward and downward on each side; lateral line suddenly bent opposite the origin of the caudal fin. Colour, a light brown on the head and along the back: on each side two rows of

ocellated spots; one row beginning at the side of the neck, and continued along the side of the back; the second row commencing behind the eye and passing along the upper side of the belly, becoming obsolete near the ventral fins; these rows are separated by numerous irregular spots, which, however, assume somewhat of a linear direction; the fins and hinder part of the back are finely barred and clouded with various tints of brown and yellow; the mouth is dark-coloured within."

The vignette represents two of the teeth; the protecting case of the young, which differs in form from that of members of the genus *Scyllium*, as shown at page 472; and a portion of the skin of the upper part of the tail, showing the arrangement of the larger scales on the upper edge, from whence it has obtained the name of *Pristiurus*, or saw-tail.



THE BLUE SHARK.

Carcharias (*Prionodon*) *glaucus*, Cuvier. Müll. und Henle, p. 36.
The Blue Shark, Watson, Phil. Trans. lxviii. p. 789, pt. xii.
,, ,, Penn. Brit. Zool. vol. iii. p. 143.
Carcharias glaucus, Flem. Brit. An. p. 167, sp. 13.
Squalus ,, Jenyns, Brit. Vert. p. 499.

Carchariadæ. *Family Characters.*—Sharks, with two dorsals and an anal; the first dorsal standing over the space between the pectorals and ventrals; a nictitating membrane, but no spout-holes in adults; one or two of the posterior stigmata situated over the pectoral fin. Head flat. Nostril generally furnished with a small three-sided flap on its upper border. Pupil perpendicularly oval. Mouth boldly convex, the corner-fold small. Teeth compressed, with a scalene triangular outline, and either a smooth or a serrated cutting edge. Anal standing either directly under or close behind the second dorsal. A small three-sided pit usually exists at the root of the caudal, both above and below; and the fin has always a short under lobe, and a notch in the under edge at the obliquely-docked end of the upper lobe. Intestinal valve rolled longitudinally, not scalariform. Scales small; skin smoothish.

Carcharias. *Generic Characters.*—Nostrils lateral, either midway between the end of the flattish snout and the mouth, or nearer the latter. Labial cartilages either small or wanting. Yelk-bag connected with a kind of uterine placenta: oviduct smooth or villous.

Müller and Henle divide the genus Carcharias into sub-genera, characterized by their dentition. The sub-genus *Prionodon*, to which the Blue Shark belongs, has the teeth of both jaws finely serrated, standing obliquely or straight, and either three-sided or with a slender cusp springing from a broader basis. Almost always

there exists a solitary mesial tooth on the mandible; and the yelk-bag is smooth and destitute of villi. In the Blue Shark the first dorsal is nearer to the ventrals than to the pectorals.

The affection of the Blue Shark for its young is the theme of several of the older writers, ichthyologists as well as poets; and mariners of the present day believe that, when danger appears, the young brood enter the mouth of the parent fish, and take shelter in its belly. Living young have doubtless been found in the stomachs of large Sharks: their extraordinary tenacity of life is proverbial, and will account for this; but the safety to be expected from incarceration in such a prison is somewhat problematical.

The Blue Shark is an inhabitant of the Mediterranean, and appears to occur much more frequently on the Devonshire and Cornish coasts than on any other part of the British Islands; it has been taken in the Bristol Channel, and in Swansea Bay; also off the south and east coasts of Ireland, and has been known to wander even as far north as Zetland.

Mr. Couch, who has had frequent opportunities of seeing this species, makes the following observations:— "The Blue Shark is migratory, and I have never known it arrive on the coast of Cornwall before the middle of June; but afterwards it becomes abundant, so that I have known eleven taken in one boat, and nine in another, in one day. The injury they inflict on the fishermen is great, as they hover about the boats, watch the lines, (which they sometimes cut asunder without any obvious motive,) and pursue the fish that are drawn up. This, indeed, often leads to their own destruction: but when their teeth do not deliver them from their difficulty, they have a singular method of proceeding,

which is by rolling the body round so as to twine the line about them throughout its whole length; and sometimes this is done in such a complicated manner, that I have known a fisherman give up any attempt to unroll it as a hopeless task. To the Pilchard drift-net this Shark is a still more dangerous enemy, and it is common for it to pass in succession along the whole length of the net, cutting out, as with shears, the fish and the net that holds them, and swallowing both together. It produces its young early in June."—*Couch.*

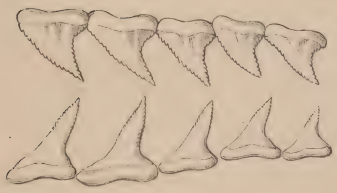
The specimen described measured fourteen inches; the head is depressed and broadest between the eyes, and half-way between the eyes and the point of the nose are the linear nostrils, directed obliquely downwards and backwards, and covered inferiorly with a valvular fold of skin; the teeth in this specimen were very minute,—in each jaw there are three rows of teeth, those immediately in the centre, to the number of four, being calculated more for holding than cutting; the number of rows of teeth in the Sharks are said to increase with age, and they vary in this species from one to six. The fourth stigma is placed over the anterior edge of the pectoral fin, which is large and falciform; the body is deepest at the shoulder, and is more compressed and tapering from thence to the tail; the first dorsal fin is rather small, low and rounded above, with a horizontal basilar elongation behind: the ventral fins are small, and obliquely truncated; the anal fin is opposed to the second dorsal fin, and each of these fins has a projecting posterior tip; the falciform upper lobe of the caudal is two-thirds longer than the lower triangular one, and the vertebral column is continued along it.

The whole of the upper surface of the head, back, both dorsal fins, and most of the tail, are of a fine

slate-blue; the irides, upper surface of the pectoral and ventral fins, are also blue; the lower part of the sides, under surface of the head, neck, pectoral fins, belly, ventral fins, and the anal fin to the base of the tail, are white. The skin of this Shark is granulated, and is only slightly rough when rubbed against the grain.

The teeth represented below are the first five of the upper jaw and mandible, beginning from the centre of the mouth in front. The teeth of the Sharks generally diminish gradually in size from the front to the angle of the mouth, and when they are pointed and curved, the point is directed laterally.

TEETH OF BLUE SHARK.



THE HAMMER-HEADED SHARK.

Sphyrna zygæna, Müller und Henle, Plagiost. p. 51.
Zygæna malleus, Val. Mem. du Mus. t. ix. p. 222.
,, ,, Yarrell, Edit. 1st. Suppl. p. 61.

Sphyrnædæ. *Family Characters.*—Sharks, resembling the *Carchariadæ* in the number and position of the fins, in having no nictitating membrane, and no spout-holes; but having a great lateral prolongation of the orbits of the skull, with the eyes at the end, and a blunt snout with the nostrils in front.

Sphyrna. *Generic Characters.*—Nasal flap small, with a trilateral lappet on the inner border of the nostril. Labial cartilage small. Teeth alike on both jaws, in form of flat pyramids, pointing to the corners of the mouth, with an exterior basal edge, which is either smooth or serrated. First dorsal situated nearer to the pectorals than to the ventrals, and larger than the second, which stands over the anal. Distinct tail-pits. Oviduct villous: yelk-bag not connected with the sides of the ovisac.

In the Sketch of the Natural History of Yarmouth and its Vicinity, by C. J. and James Paget, it is stated that a specimen of the *Squalus zygæna*, or Hammer-headed Shark, was taken there in October 1829, and deposited in the Norwich Museum; and by the kindness and influence of J. H. Gurney, Esq., of Norwich, the drawings that were made from that specimen were sent to London for use in this work.

In August 1839, another example of this species of Hammer-headed Shark was taken in a herring-net off the Monkstone rocks, about two miles to the west of Tenby. Of the capture of this fish notices were received from the Rev. T. Salwey of Tenby, Dr. John Ford Davis of Bath, and J. Dillwyn Llewelyn, Esq. of Penllergare. The latter gentleman has published an account, with measurements of the fish and other particulars, in a paper communicated to the Royal Institution of South Wales; and Mr. Salwey's obliging letter contained an excellent outline of the form, with various measurements. The whole length of the fish, when fresh, was ten feet three inches; the circumference of the body six feet, and it was supposed to weigh between six and seven hundred pounds: the teeth were in six rows, flat, pointed, curved, and sharp; the back of a dark greenish lead colour, and reddish-yellow on the belly. When opened on the third day after capture, the body contained thirty-nine young ones, perfectly formed, and each about nineteen inches in length.

Among the numerous species included in the genus *Squalus* of Linnæus, there is no form more extraordinary than that of the Hammer-headed Sharks, four species of which are noticed in the memoir by M. Valenciennes, quoted above, where they are considered as a sub-genus, under the name of *Zygæna*.

The Hammer-headed Shark taken on the coast of Norfolk and at Tenby, being also a native of the Mediterranean Sea, has been long known, and is figured in the works of Belon, Rondelet, and Salvian. The figure at the head of this article is taken from the *Fauna Italica* of the Prince of Canino. Its greatest singularity consists in the extraordinary form of the head; but its habits, as far as they are known, afford no physiological illus-

tration of this very remarkable structure. In other respects it is very like the Sharks in general. This species is said to be ferocious, to frequent deep water, and it measures from seven to twelve feet in length. The female produces many young ones, which are of considerable size at the end of autumn. In some countries the flesh of several species of Shark is eaten, but that of the Hammer-headed Shark is said to be not only hard, but very unpleasant both in smell and flavour.

Representations of the upper and under surfaces of the head of this Shark, on a small scale, are given below; when measured from one eye to the other, it is very wide; the eyes are furnished with eye-lids, which arise from the internal part of the orbits, the irides are golden yellow, the pupils black; the nostrils are elongated, and

open immediately underneath the depression, or notch, in the anterior margin of the laterally-expanded portions of the head; the mouth is semicircular, and is furnished with three, four, or five rows of teeth, depending upon the age of the specimen; these teeth are large, sharp, somewhat triangular and curved, with smooth cutting

edges when the Shark is young, but serrated afterwards, the teeth in the upper jaw having their points directed towards the angle of the mouth; those of the lower jaw have the same direction, but they are narrower.

The body, covered with a slightly-granulated skin, is greyish-brown above and nearly white beneath; all the stigmata are before the base of the pectoral fin; the pectoral fins are nearly triangular; the first dorsal fin is large; the second small, and placed just in advance of the commencement of the tail; the inferior lobe of the tail is small, but the superior portion is as long as the head of the fish is wide; the anal fin is under the second dorsal.

This species is found in the Mediterranean, on the shores of the various countries of Europe, in the ocean, on the coast of Brazil, in the Caribbean Sea, and Atlantic coasts of the United States.

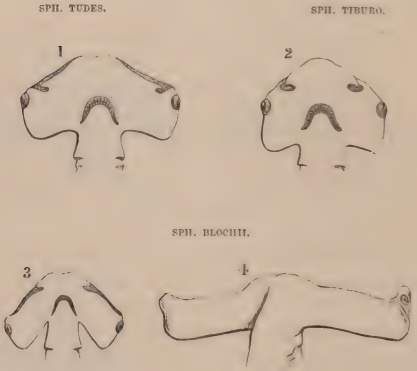
To complete this subject, and afford the means of identifying any other species of *Zygæna* that might wander to our shores, representations of the heads of the other known species are subjoined, No. 1 being *Sphyrna tudes* (*Zygæna tudes* of Valenciennes), a native both of the Coromandel and Cayenne Seas. Müller and Henle are somewhat doubtful about the existence of this species as distinct from *Sphyrna Zygæna*, which varies much in the form of the head.

No. 2, *Sphyrna tiburo*, is the Arrow-headed Shark of the Supplement of Pennant's British Zoology, and the Heart-headed Shark of Shaw's General Zoology. It has been found only on the coasts of Brazil and China.

Nos. 3 and 4. The young and adult of *Sphyrna Blochii*. In this species the nostrils are nearer the mesial line of the head, the front and posterior outlines of the head are nearly parallel, and the second dorsal is near the caudal. The adult state of this Shark, represented by fig. 4, is

the *Zygæna laticeps* of Cantor, and on Bloch's plate 117, it is called *Squalus Zygæna*, or the Balance Fish. In the fœtal state the cartilage of the skull of these fishes is flexible, and the orbital expansions are folded up, so that the great lateral breadth, which the head afterwards attains, does not appear. Bloch's Sphyrna is a native of the Indian Ocean, and is not uncommon in the Bight of Benin.

In addition to these a fifth species, *Sphyrna Mokarran* of Rüppell (Chondropt. xvii. 3), is recognised by Müller and Henle. Specimens from the Red Sea exist in the Frankfort Museum.



THE COMMON TOPE.

PENNY DOG; MILLER'S DOG.—CI-GLAS, *Wales.*

Galeus canis, Rondel. Müll. und Henle, Plagiost. p. 57.
Squalus galeus, *Tope Shark*, Penn. Brit. Zool. iii. p. 146, pl. 18.
Galeus vulgaris, *Common Tope*, Flem. Brit. An. p. 165, sp. 6.
" " " " Thompson, Nat. Hist. of Irel. iii. p. 252.

Galeidæ. *Family Characters.*—Sharks, with two dorsals and an anal fin: the first dorsal standing over the space between the pectorals and ventrals; nictitating membranes and spout-holes present; the last, or the last two stigmata over the pectorals. Nostrils, orbits, mouth and its corner-folds as in the *Carchariadæ*, but with small labial cartilages. Spout-holes small, longitudinal or round. Teeth in both jaws alike, flat, with cutting edges, their points directed obliquely towards the corner of the mouth, and with a heel on the outer side; their edges are either quite entire, or serrated only on the outer side, or on both. The anal fin stands close before, behind, or opposite to the second dorsal; and the upper lobe of the caudal has one or two notches. The caudal pit is present or wanting, and the spiral valve of the intestine is either screw-shaped or cylindrically rolled. Scales small, three-keeled, with a mesial cusp.

Galeus. *Generic Characters.*—Spout-holes longish, half the length of the orbits behind the eyes; pupils round above, angular below. Teeth smooth, or occasionally faintly serrated interiorly, distinctly serrated on the outer border, from which the smooth cusp projects outwards. The front teeth are straight, serrated at the base on both sides, and as broad as the lateral teeth. No caudal pit, and only one notch on the upper caudal lobe. Intestinal valve screw-shaped.

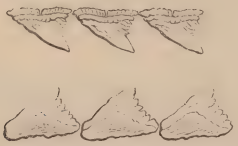
The Tope is a common species along the southern coast, where it is known by the name of Penny Dog and Miller's Dog; it has also been noticed by Pennant

in Flintshire; and by others on different parts of the coast of Ireland. It is not, however, considered so plentiful in the north, but has been taken about Berwick Bay, and its occurrence there is noticed by Dr. Johnston in his address to the Members of the Berwickshire Natural History Club for the year 1832. It has also been taken in the Frith of Forth, as recorded by Dr. Parnell, and Mr. Thompson mentions it as having been captured on all the Irish coasts.

On the Cornish coast the Tope is a common and rapacious species; but it is not so destructive as the Blue Shark. The larger specimens, which are about six feet long, abound chiefly in summer; and the young, to the number of thirty or more, according to Mr. Couch, are excluded at one birth from the female in May and June. They do not reach the full size until the second year, and continue with us through the first winter, while those of larger size retire into deep water. No use is made of this species beyond melting the liver for oil. When caught on a fisherman's line, this fish sometimes has recourse to the same attempt at deliverance as the Blue Shark, by twisting the line throughout the whole length round its body.

Body fusiform: the skin almost smooth; lateral line straight; the first and second dorsal fins rather small, triangular, very slightly convex on their posterior edges, both ending in points directed backwards; the first dorsal fin placed over the interval between the pectoral and ventral fins; the second immediately over the anal fin, and a little larger than it in size: the head is rather large; the muzzle elongated and depressed; nostrils pierced very near the mouth, in part closed by a membrane; the eyes moderate, and over the mouth; temporal

orifices small; the jaws semi-circular; teeth small, in several rows, and very nearly alike both above and below, triangular and denticulated on the outer side; the branchial apertures are small, placed near together, the first four nearly equal in size, the fifth the smallest, and



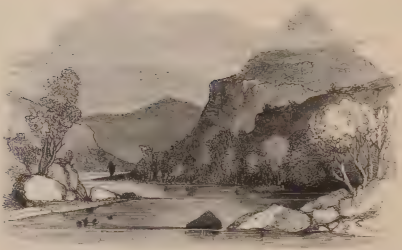
placed over the anterior edge of the pectoral fin; the pectoral fins are of moderate size, triangular in shape, with rounded corners and a straight edge; the ventral fins are small, and situated near the middle of the whole length, under the space between the first and second dorsal; the tail is rather less than half the length of the body, with a bilobed fin, whose upper lobe is terminal, oblique, truncated, and about twice as long as the inferior one.

All the upper parts of the body and sides are of a uniform slate-grey, the under surface is lighter in colour, inclining to greyish-white.

Another generic form of this family, the GALEOCERDO ARCTICUS of Müller and Henle inhabits the seas of Norway, Iceland, and the Feröe Islands, and may therefore be occasionally found among the Zetlands or Orkneys. It may be the White Shark of the Orkneys of which Lowe had heard but not seen. The teeth of the

Galeocerdo arcticus are represented under the generic appellation of *Galeus*, by Owen in his Odontographia, pl. 28, fig. 9, and by Agassiz, tab. E, fig. 5, 6.

THE STACK, SUTHERLANDSHIRE.



Stranger! if e'er thine ardent step hath traced
The northern realms of ancient Caledon,
Where the proud Queen of Wilderness hath placed,
By lake and cataract, her lonely throne;
Sublime but sad delight thy soul hath known,
Gazing on pathless glen and mountain high,
Listing where from the cliffs the torrents thrown
Mingle their echoes with the eagle's cry
And with the sounding lake, and with the moaning sky.

Scott.

THE SMOOTH HOUND.

SKATE-TOOTHED SHARK. STINKARD. RAY-MOUTHED DOG.

Mustelus vulgaris, Müller und Henle, Plagiost. pp. 65 and 189.
,, *lævis,* Flem. Brit. An. p. 166.
Squalus mustelus, Smooth Shark, Penn. Brit. Zool. vol. iii. p. 151.
,, ,, ,, ,, Jenyns, Man. Brit. Vert. p. 502, sp. 192.

Mustelidæ. *Family Characters.* — Nictitating membranes, spout-holes and position of the fins and stigmata as in the *Galeidæ* and *Scylliodontidæ*. Spout-holes large; orbits longish; nictitating membrane puffed out, and appearing like a doubling of the under eye-lid. Teeth pavement-like, flat, without cusp or sharp edge, and resembling the teeth of a Skate. A three-sided cutaneous lappet, with rounded tip, embraces three-fourths of the nostril above, and on the outside of it there is a shorter blunt lappet. The first dorsal stands nearly midway between the pectorals and ventrals. Caudal fin short, and the caudal pit indistinct. Intestinal valve screw formed.

Mustelus. The sole genus in the family.

This Shark is rather a common species round our coasts, and Dr. Fleming says that the flesh of it is used as food in the Hebrides, and is esteemed a delicacy. It is called Smooth Hound, from the comparative softness of its skin in reference to British Sharks in general; and it is also called Ray-mouthed Dog in Cornwall from the form of its teeth, which are flat and without prominent points, like those of the female or young male of the Thornback. The vignette represents an inside and an

outside view of one-half of the mouth and teeth of this Shark, which are so different from those of any other British Shark as to form a distinguishing character. Their resemblance to those of the Skate may be seen by comparing the vignette with that representing the teeth of the Thornback in a future page.

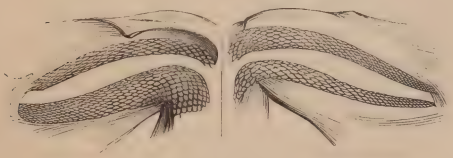
The young of the Smooth Hound have frequently numerous small white spots above the lateral line; but the teeth and other characters agree so closely with the spotless grey examples of larger size, that I am induced to consider these spots as marks of youth, similar to those observed in other species, particularly in the Picked Dogfish, *Spinax Acanthias*.

Mr. Couch says of this species, in reference to its habits, that it is common, but not abundant, and keeps close to the bottom on clean ground, where it feeds on crustaceous animals, which it crushes with its flat pavement-like teeth: it also takes a bait, but is less rapacious than most of the tribe. The young are produced alive in November, the whole coming to perfection at once; but they are few in number, not perhaps exceeding a dozen, and soon after birth they all go into deep water, from which they do not emerge until the following May.

This species has been taken, according to Mr. Thompson, on the north and south coasts of Ireland, and particularly in Belfast Bay, Dublin, and Youghal.

The specimen described measured eighteen inches in length; the top of the head is flat and rather broad; the beginning of the back elevated and rather rounded; the eye large, lateral and elongated horizontally; the spout-holes are rather small, and are placed immediately behind the angle of the eye: the first dorsal fin is considerably larger than the second, and both have the same shape,

and an elongated free basal point projecting backward; the centre of the first dorsal is placed at the distance of six inches, and that of the second at twelve inches, from the point of the nose. Under surface of the head flat; the nostrils semilunar, each with an upper central cutaneous valve: the mouth half the width of the whole under surface, rather angular in shape than semicircular, and at the corner on each side there is a loose elongation of the upper lip. The teeth are small and flat, like those of a young Skate. The pectoral fins are large, commencing at three inches and a half from the point of the nose, and the ventrals are attached under the space between the two dorsals; the anal fin begins under the middle of the second dorsal fin, yet being only half its size, ends but a little behind it: the upper part of the caudal fin is a long narrow horizontal slip and the free part of the under portion is made up of two triangular portions, the first of which is long, the last one short. The surface of the body is smoother than that of Sharks in general, and the colour of the upper part of the head, body, and fins, is pearl-grey; that of the under parts greyish yellow-white: the lateral line is prominent; above it the body throughout its length is marked with numerous small circular white spots, which, as before stated, are most conspicuous in the young fish.



THE PORBEAGLE, OR BEAUMARIS SHARK.

Lamna Cornubica,	*Le Squale Nez*,	Cuvier. Müll. und Henle, Plagiost.
,, ,,	*Porbeagle*,	Flem. Brit. An. p. 168, sp. 15.
Squalus Cornubicus,	,,	Penn. B. Z. iii. 152 and 254, pl. 20.
,, ,,	*Shark*,	Donov. Brit. Fish. pl. 108.
,, ,,	,,	Goodenough, Linn. Trans. iii. 80, t. 15.
,, ,,	,,	Jenyns, Man. Brit. Vert. p. 380.

Isurus Cornubicus, Gray, Chondr. Brit. Mus. p. 58.

Lamnædæ. *Family Characters.*—Sharks having two dorsals and one anal; the first dorsal standing between the pectorals and ventrals. Spout-holes, but no nictitating membrane. Stigmata long, and wholly before the pectorals. Orbits roundish. Anal and second dorsal small, equal to and opposite one another. Distinct caudal pits. Caudal fin crescentic. Tail keeled on each side. Spout-holes very small. Intestinal valve screw-formed.

Lamna. *Generic Characters.*—Snout three-sided, pyramidal, pointed. Spout-holes very small, far behind the eyes, and easily overlooked. Teeth lancet-shaped, not serrated, with an acute basal denticle on each side of the tooth of the adults, and occasionally two denticles. The basal surface of the tooth applied to the jaw is moderately concave. Instead of a mesial tooth there is a void space in each jaw: after the first two teeth, on each side of the upper jaw there follow one or more smaller teeth. Skin smooth, and its scales very small.

In the first edition of this work, the Beaumaris Shark was considered to be distinct from the Porbeagle, but

opportunities of examining four specimens which have been taken on different parts of our coast between 1837 and 1841 led to the belief of the differences observed being only the effects of greater age, and they were therefore brought together under one specific name.

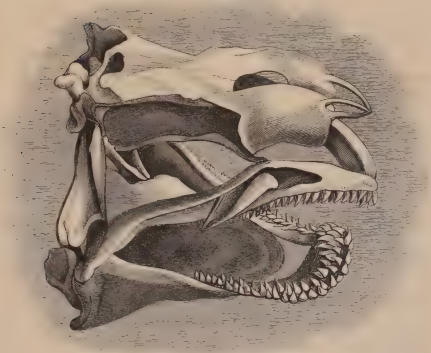
The Porbeagle occurs occasionally on the northern and frequently on the southern coasts of this country, and also on different parts of the Irish coast. It is not rare, according to Dr. Baikie, among the Orkney Islands. The specimen described and figured by Dr. Goodenough in the Transactions of the Linnean Society was taken at Hastings; Mr. Couch has seen it occasionally in Cornwall, and it was figured by Dr. Borlase in his history of that county. The Portsmouth fishermen procure several examples every year, and it often proves a troublesome guest in their mackarel nets. Notices of the capture of this Shark on various parts of the coast are recorded in the Zoologist at pages 1974, 2970, 3058, 3487, and 3712. Of those taken in the Moray Frith, one was found in a salmon net, and two were caught by common haddock lines, one of them measuring above seven feet in length, and over four feet in circumference. Mr. Couch states of this species, "That it associates in small companies in pursuit of prey, from which circumstance, and a distant resemblance to the Porpus, they derive their name. I have found the remains of cartilaginous fishes and Cuttles in their stomachs, and in one instance three full-grown Hakes. This species attains a large size at an early age, so that I have found it cutting its second row of teeth when nearly full-grown." Mr. Charles Barron remarks on the resemblance of the general profile of this fish to the large Scomberoids, of whose sculls it is a close follower. On the northern and north-east

coast it occurs most frequently during autumn. The annexed cut of the teeth was drawn from one of two specimens procured by Dr. George Johnston, in the autumn of 1834, in Berwick Bay.

"Body fusiform, very narrow at the tail, and strongly keeled there on each side; skin smooth when stroked backwards, of a uniform greyish-black colour, the belly white; snout obtusely pointed, with a band of punctures on each side of the forehead terminating above the eyes, a few similar punctures behind the eyes, and a triangular patch of them before the nostrils; they are the apertures of canals filled with a transparent jelly: eyes round, dark blue; branchial slits five, cut across the neck, the posterior oblique and close to the pectoral fin; back rounded; first dorsal fin triangular, with a free pointed pale-coloured process behind; second dorsal fin also pointed posteriorly; pectorals somewhat triangular, oblique, black on the posterior edge; ventral fins rhomboidal, meeting at the mesial line, on which are the anal and sexual apertures; anal fin small, pointed behind; tail lunate, with unequal lobes, the superior and largest with a projecting outline near the tip; on the dorsal aspect of the tail there is a flat space bounded by a short transverse ridge, and a similar one opposite to it on the ventral side: lateral line straight; the keel on the body runs forward on the tail, and there is a small keel beneath this confined to the tail itself. The length along the lateral line, five feet eight inches and a half; circumference in front of the dorsal fin, two feet eight inches and a half; from the snout to the eye four inches and three-quarters; breadth between the eyes, five inches and one-quarter;

breadth of the mouth from angle to angle, eight inches and one-quarter; from snout to dorsal fin, two feet one inch and three-quarters; height of dorsal fin, nine inches and three-quarters; length of dorsal fin, ten inches and one-quarter; space between the first and second dorsal fins, one foot eight inches; length from the snout to the anal aperture, three feet eight inches; extreme breadth of the tail, one foot eight inches; length of the tail on the mesial line, six inches and one-quarter."—*Dr. George Johnston.*

SKULL OF THE PORBEAGLE.



THE WHITE SHARK.

Carcharodon (Requiem), Müller und Henle, Plagiost. p. 78.
Perlz Fische de Norwege, Belon. 58.

Carcharodon. *Generic Characters.*—Snout, position of the fins, and spout-holes as in *Lamna*. Teeth trilateral, with serrated edges, like those of *Carcharias*, but with equal cutting sides, and without a basal ledge: no mesial tooth. The third tooth of the upper-jaw is somewhat smaller than the two preceding ones, or than the one which immediately follows.

British writers on Ichthyology have recognised the existence in the northern seas of a White Shark, but none have described it except in very general terms, with the omission of most of the particulars requisite for identifying the species; and the synonyms which Pennant and others have accumulated being equally doubtful have only increased the confusion. In the two former editions of British Fishes this uncertainty was fully recognised, along with the admission that an imperfectly-known Shark was occasionally seen on the British coasts; and to assist observers figures of two distinct species, both known by the name of White Shark, were given. The first of these, reproduced above, was copied from Belon, and of it Cuvier says in the *Règne Animal* that it

is the only good representation of the *Requiem*, which he considers to be the *Squalus carcharias* of Linnæus. It is not known, however, to what species Linnæus gave that name. That Cuvier's *Requiem* is not a *Carcharias* appears by his description of the teeth, which in the upper jaw are not oblique, but in the form of an isosceles triangle, with straight serrated sides, and on the mandible have a narrower cusp and a broader base. Belon's figure, it will be observed, has a pointed snout, with large pectorals, large first dorsal and a crescentic caudal, whose upper lobe is longer than the under one. The stigmata, moreover, are wholly before the pectorals. From these characters Müller and Henle (p. 78) refer it to *Carcharodon*, but neither determine nor name the species.

Belon says that the Norwegians name the Shark that he figures *Perlz fish* (signifying *Poisson de Montagne*) because of its bigness, and that its weight reaches two hundred pounds. Its skin, he tell us, is hard and rough; its front teeth round and pointed, and its hind ones round and flat, like those of *Lamia;* and Müller and Henle consider the *Lamia* of Belon (p. 98) to be a doubtful synonym of the genus *Carcharias*. The crescentic caudal resembles that of the Porbeagle; but the gill-openings are dissimilar in form and position.

Cuvier says that the *Requiem* reaches the length of twenty-five feet, is a native of all seas, and the dread of navigators, but that sailors give the same name to other Sharks with cutting teeth. The teeth of *Carcharias verus*, represented by Agassiz in his *Poissons Fossiles* (vol. iii. t. F. fig. 3), are those of *Carcharodon Rondeletii* of Müller and Henle. Until the real characters of the White Shark are ascertained, references to authors respecting it must be uncertain.

Of the *White Shark* of Pennant, vol. iii. p. 139, Müller

and Henle venture to say no more than that it is a *Squalus* (*Plagiost.*, p. 102), and of the synonyms collected by Pennant, Cuvier considers Gesner's figure to be monstrous, and Willughby's is a copy of it. Ray's *Canis carcharias* (*Syn. Pisc.*, p. 18) is thought by Müller and Henle to belong to their *Carcharodon Rondeletii* (Plagiost., p. 70), of which *Lamia* or *Tiburo* of Rondelet (p. 489, t. 390) is a synonym. In the edition of 1812, of Pennant, reference is made to the *Fauna Groenlandica* of Otto Fabricius for the habits of the White Shark, but Müller and Henle think that Fabricius has confounded a *Carcharias* with a *Læmargus*, his reference to Gunner being decidedly applicable to *Læmargus borealis*, while his description by no means answers to that species. Fabricius says that the pectoral fins are of the largest size, and the upper lobe of the vertical caudal extremely long (*longissima*), and makes no mention of the anal. The anal is very small in the Fox Shark, and this being the species, above all others, which has the upper lobe of the caudal answering to the epithet used by Fabricius, it was, perhaps, that fish which he saw and described, however erroneous he may have been in his references. He may, however, have seen the *Galeocerdo arcticus*, and he says, moreover, that an exact representation of his fish is to be found in the Acta Nidros. vol. ii. p. 330, tab. xxi., where it is named *Haaskierding*, which is an appellation of this as well as of the *Læmargus borealis*, and most probably of various other Sharks.

Dr. Fleming's *Carcharias vulgaris* (Brit. An. p. 167) was over twenty feet long, and had trilateral serrated teeth, with the last stigma situated over the base of the pectoral, and a large triangular pectoral. This is referred to *Carcharias* by Müller and Henle, but they cannot determine the species.

Mr. Low mentions the White Shark as an Orkney fish, but he never saw it, and the one he heard of may have been the *Scymnus borealis*, or the *Galeocerdo arcticus*, the Porbeagle, or indeed any of the large northern Sharks with lacerating teeth. To which, if to any of them, the Rashleigh Shark of Mr. Jonathan Couch (Linn. Tr. xiv. 91) is to be referred, remains to be ascertained. Mr. R. Quiller Couch, in the Zoologist for 1848 (1973) says that the White Shark is not uncommon off the Land's End, and Tol-pedn-Penwith, and he gives a figure of a Shark that he had examined, which he seems inclined to consider as a young individual of that species. That figure shows no spout-holes, and it may be a *Carcharias*, but without a knowledge of its dentition it cannot be distinguished from a *Galeocerdo* or *Carcharodon*.

In the Zoologist for 1857 (5366) it is stated that Mr. C. F. Lukis, the well-known naturalist of the Channel Isles, found in August, among the rocks of the Island of Herm, a White Shark, twelve or fourteen feet long. No description of this specimen has appeared, but Mr. R. Q. Couch, in p. 5528 of the same work, after referring to the Herm Shark, goes on to say:—"I am quite aware that my valued friend the late Mr. Yarrell always entertained an objection to admitting it (the White Shark) into his work, because the evidence was not sufficient to convince him of the species; but he was aware of the existence of a Shark which was either the White Shark, or altogether a new one." . . . . "Within the last three years (1855-7) I have had an opportunity of examining several specimens, two of them taken in Whitsand Bay, and one in Mount's Bay. One taken at the Land's End measured more than nineteen feet, was a stout, powerful fish, and is well represented by Yarrell's figure." . . . . "Last summer (1856) I com-

pared two examples taken in Mount's Bay with many scores of the Blue Shark, which were thrown on the beach. The general appearance of both is much alike, but the colours are altogether different, that of the White Shark being neutral tint, inclining to gray, interspersed with red and flesh-colour. The eye is rather larger than in the Blue Shark, and the nostril larger, and rather below the level of the eye; the branchial orifices are much nearer the snout, and the pectoral fins are smaller and farther forward than those of *Carcharias glaucus*. The dorsal fin is smaller, more anterior, and not elongated posteriorly; the tail-fin is larger, stouter, and the posterior and terminal margin of its upper border is very much larger and more falcate than in the Blue Shark."—*Couch*.

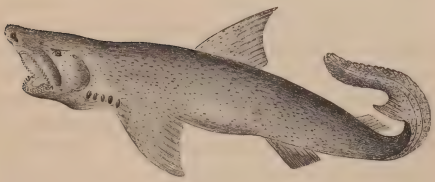
The above quotations may assist in elucidating the history of this obscure species, which has been greatly involved by observers taking for granted that the White Shark was a known and determinate species. Minute and accurate descriptions and drawings are needed. Perhaps one of the Sharks named "White" by British fishermen may prove to be the *Carcharodon Rondeletii*.

The terminal vignette represents another species, which has also been called White Shark, and may assist observers on the coast. It is a copy of the *Squalus carcharias* or *La Lamie* of Bloch, t. 119, considered by him to be identical with the White Shark of Pennant, and, consequently, with the *Chien carcharien* or *Perlz fisch de Norvege* of Belon. Belon's plate, copied at the beginning of this article, is quoted by Pennant as a representation of his fish, and a comparison of the two figures will suffice to show how loosely such quotations were formerly made. Cuvier, as has been already mentioned, says that Belon's figure is the only good one of his *Sq. carcharias*, or *Re-*

quiem, while Bloch's (pl. 119) represents a Shark allied, he thinks, to *Scymnus*, but Müller and Henle (p. 50) consider it to be a dubious synonym of *Carcharias*, and that the anal fin has been omitted by the artist. It is evidently little to be trusted as a correct portrait of a real fish.

A reference to Swedish authorities has not cleared away the difficulty of determining the Great Norwegian Shark of Belon, or this anomalous one of Bloch. Sundevall, in the *Skandinaviens Fiskar*, says that the Blue Shark is a stranger to the northern seas, having been only once seen near Jutland; and that the *Galeocerdo arcticus* is scarcely known on the Scandinavian coasts. He adds that the Norwegian epithet of Hâmär, which has been said to refer to it, certainly is not applied to it exclusively, and that the designation of Great Shark, or *Hâstörje*, is given to the Common Tope of our seas.

LA LAMIE OF BLOCH.



THE BASKING SHARK.

THE SUN-FISH, and SAIL-FISH.—HEULGI, *Wales.*

Selache maxima, CUV. MÜLL. und HENLE, p. 71.
Squalus maximus, Basking Shark, PENN. Brit. Zool. iii. 134, pl. 16.
,, ,, *Common Sail-fish,* FLEM. Brit. An. p. 164.
,, ,, *Basking Shark,* JENYNS, Man. Brit. Vert. p. 503.
,, ,, HOME, Phil. Trans. 1809, pl. vi. wants the anal.
Cetorhinus maximus, GRAY, Chondropt. Brit. Mus. p. 61.

SELACHE. *Generic Characters.*—Snout short and blunt; spout-holes small. Branchial openings, vertical slits that nearly encompass the throat. Teeth very small, numerous, conical, with smooth edges, and no lateral denticles, their points retrocurved. Skin roughened by the points of small scales, which are bent in all directions.

THE BASKING SHARK, so called from its habit of remaining occasionally at the surface of the water almost motionless, as if enjoying the influence of the sun's rays, and termed, therefore, on some parts of the Irish and Welsh coasts, Sun-fish, is one of the largest of the true fishes, and has been known to measure thirty-six feet in length. It is seen generally from the month of June to the commencement of winter. When northerly winds prevail, it is most frequent on the west coast of Scotland. It is known also on the north and west coasts of Ireland, where it frequents the herring bays and injures

the fisheries. If westerly winds prevail, it is not unusual to meet with it along the whole line of the southern coast. It has been taken on the coasts of Waterford, Wales, Cornwall, Devonshire, Dorsetshire, and several times at different places on the coast of Sussex. The specimen described and figured by Sir E. Home, in the Philosophical Transactions for 1809, was taken off Hastings; and a specimen, which measured thirty-six feet in length, was caught some years since off Brighton. From our southern coast it frequently wanders as far to the eastward and south as the coast of France; and the fish described and figured by M. de Blainville in the eighteenth volume of the *Annales du Muséum*, doubtless is the same species as that described by Sir E. Home, which has been already referred to.

The difficulty of obtaining a perfect view of this unwieldy fish, either when floating in water, or when from its great weight it lies partly imbedded in the soft soil of the sea-shore, has led to the differences which appear in the representations of it which have been published by different naturalists.

The Basking Shark is said to exhibit but little of the ferocious character of the Sharks in general, and is so indifferent to the approach of a boat as to suffer it even to touch its body when listlessly sunning itself at the surface. From its habit of swimming slowly along with its dorsal fin, and sometimes part of its back, out of water, it has obtained in the North the name of Sail-fish. In Orkney it is called Hoe-mother, and by contraction Homer,—that is, the mother of the Picked Dog-fish, which is there called the Hoe.* If deeply struck with a

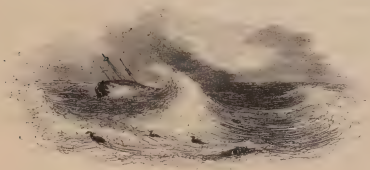
* The Orkney "Homer" evidently originated in the Norwegian *Hámar*, by which the Porbeagle and *Scymnus borealis*, or any large Shark, is designated; and the modern Hoe-mother is merely an attempt to give significance to a name no longer understood.

harpoon, the Basking Shark plunges suddenly down, and swims away with such rapidity and violence as to become a difficult as well as a dangerous capture. This species has the smallest teeth in proportion to its size of any of the Sharks. No remains of fish have been found in its stomach. One examined by Mr. Low contained a red pulpy mass, like bruised Crabs, or the roe of *Echini*. Mr. Low adds, that this Shark's appearance, manners, and weapons do not indicate it to be a ravenous fish. Linnæus says that its food is *Medusæ*, and Pennant thought that it subsisted on marine plants.

The body is thickest about the middle, and diminishes towards both extremities; when afloat the form is nearly cylindrical; the skin is thick and rough, of a brownish-black colour, with tints of blue. The head conical, the muzzle short, rather blunt, smooth, and pierced with numerous circular pores; eyes near the snout, small, oval, and horizontal, the irides brown; half-way between the eye and the first branchial opening is the oblique and small spout-hole; stigmata five on each side, of great vertical length, each set including the whole side of the neck, and leaving only a small space above and below; nostrils oval, small, placed rather laterally, and opening on the edge of the upper lip; pectoral fins of moderate size for so large a fish,—perhaps, as before stated, the largest of the true fishes,—of a somewhat triangular form, placed close to the last stigma, convex anteriorly and thick, slightly concave and much thinner behind; the ventral fins also of moderate size, rather elongated at the base, placed behind the middle of the whole length of the fish, convex in front, concave behind, the inner and posterior half free, exhibiting in the specimen chosen for the wood-cut the cylindrical appendages peculiar to the male. The first dorsal fin, placed before the middle

of the whole length of the fish, is much the larger of the two, and forms an elevated triangle; its anterior edge is but slightly convex, the posterior one is concave, with an elongated point at the base directed backwards: the second dorsal fin is much smaller than the first; is rounded above, attached throughout half its base only, and placed at two-thirds of the distance between the first dorsal and the caudal fin; the anal fin is still smaller than the second dorsal, but of the same shape. From the line of the anal fin to the base of the tail there is a strong and prominent keel-like edge on each side, and just in advance of the base of the caudal fin, both above and below it there is a groove,—the under groove being rather smaller than the upper one. The caudal fin is divided into two lobes, of which the upper one is the largest; the posterior edge of the caudal fin appears to become notched and abraded by age and use, and is frequently found unequal at its margin, and variable in shape.

THE STORMY PETREL.



Her nest the wave—her fate to roam
Like bubbles of the ocean foam.

Notes and Queries.

THE FOX SHARK.

SEA-FOX. THRESHER. SEA-APE. LLWYNOG MÔR,
Wales.—PEIXE CAVALLO, *Madeira.*

Alopœcias vulpes, RAFF. MÜLL. und HENLE, Plagiost.
Carcharias ,, *Thresher*, FLEM. Brit. An. p. 167.
Vulpes marina, WILLUGHBY, p. 54, B. 6, fig. 2.
Squalus vulpes, *Long-tailed Shark*, PENN. Brit. Zool. iii. p. 145.
,, ,, *Sea-Fox*, JENYNS, Brit. Vert. p. 498.

ALOPECIÆDÆ. *Family Characters.*—Sharks, with two dorsals and one anal, and with spout-holes, but no nictitating membranes; the first dorsal standing between the pectorals and ventrals. Snout short, conical; spout-holes very small, generally overlooked. Nostril small, with a short lappet on its upper border. No labial cartilages. The stigmata small, as in *Carcharias*, and the last one placed over the edge of the pectoral. Teeth trilateral, alike in both jaws, lancet-shaped, with very entire cutting edges; the front ones straight, isosceles, the others inclined somewhat outwards, or laterally. No mesial tooth. A smooth membranous fold, with a sharp crescentic border, behind the upper teeth. Second dorsal and anal very small, opposed to each other. The upper lobe of the caudal very long with a pit at its root. Small tricuspid scales. Intestinal valve spiral.

ALOPECIAS. The single genus of the family.

THIS species is occasionally met with on the British coast: Pennant examined one that measured thirteen feet in length; and specimens have been seen of fifteen feet long. It is called the Sea-Fox from the length and

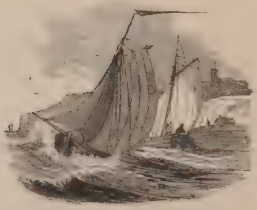
size of its tail; and, according to Dr. Borlase, has received the name of Thresher from its habit of attacking other animals, or defending itself, by blows of the tail. It is an inhabitant of the Mediterranean as well as other seas; and a specimen has been taken near Belfast.

The extreme length of a Fox Shark examined by Mr. Couch, "was in a straight line ten feet ten inches, and along the curve eleven feet eight inches; three feet four inches round where thickest; solid at the chest; conical from the snout to the pectoral fins, and thick even to the tail-fin, which organ from the root was five feet and a half long, and consequently formed more than half the whole length; eye prominent, round, hard, four inches from the snout; iris blue, pupil green: the nostrils small; mouth five inches wide, shaped like a horse-shoe; teeth flat, triangular, in two or three rows, not numerous; gill-openings five; pectoral fins wide at the base, pointed, eighteen inches and a half long. Measured along the curve, from the snout to the first dorsal fin, the distance was two feet five inches; from the first dorsal to the second, fourteen inches and a half; this and the anal fin were small; the ventral fins also were rather small and triangular; above and below at the base of the tail there was a deep depression; skin smooth; lateral line central and straight; breadth of the tail, including both lobes, thirteen inches; the upper lobe narrow throughout its great length; and on the lower margin, at four inches from the extremity, there was a triangular process. Colour of the body and fins dark blue, mottled with white over the belly."—*Jonathan Couch.*

Mr. Couch says it is not uncommon for a Thresher to approach a herd of Dolphins (*Delphini*) that may be sporting in unsuspicious security, and, by one splash of its tail on the water, put them all to flight like so many hares

before a hound. This fact had previously engaged the attention of Sir Walter Scott.

"The specimen here described was caught at the entrance of the harbour of Looe in Cornwall, in October 1826, having become entangled in a net set for Salmon. The stomach was filled with young Herrings." An example of this species was taken in a herring-net near Berwick-on-Tweed in July 1846 (Zool., 2075); and one was captured off Brighton in July, and two in August 1854; one also in Mount's Bay in the course of the summer of 1855 (Ibid, 5529). Dr. Baikie says that the Fox Shark is not uncommon in the Orkneys.



Merrily, merrily goes the bark,
Before the gale she bounds;
So darts the *dolphin* from the *shark*,
Or the deer before the hounds.

Lord of the Isles, Canto iv.

THE GRAY NOTIDANUS.

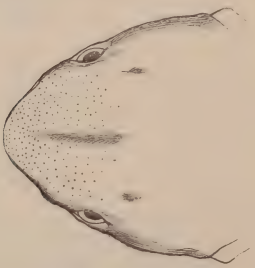
Notidanus griseus, Jonathan Couch, Zool. for 1846, p. 1337, fig.
Hexanchus ,, Müll. und Henle, Plagiost. p. 80.
,, ,, Gray, Cat. of Chondropt. Brit. Mus. p. 67.

Notidanidæ. *Family Characters.*—Sharks with a single dorsal and an anal fin. Head flat. A small three-cornered nasal lappet. Upper fold at the corner of the mouth very large, the under one small. Nictitating membrane wanting. Tongue adherent. Spout-holes small, perpendicular. Six or seven stigmata, diminishing successively in length, and all before the pectoral fin. A mesial tooth on the mandible: the next five or six under-teeth form a saw, by the projection of their conical cusps; the fore or inner borders of the mandibular teeth are either smooth or wholly and finely serrated; and the outer teeth of that jaw are small and flat. In the upper jaw the teeth are longer, more slender and more pointed, and their first denticle is much longer than the rest: the outer border of the upper teeth is thick, the inner one finely serrated towards its base: the foremost are hook-shaped, on a broad base, and are clustered: the next in succession have exteriorly one or two lateral denticles; and towards the corner of the mouth, the upper teeth resemble the under ones. Lateral line distinct. The single dorsal stands behind the ventrals, and partly before, partly over the anal. The caudal has small under lobes, with a notch towards the end, which is obliquely or directly docked. No caudal pits. Intestinal valve screw-shaped.

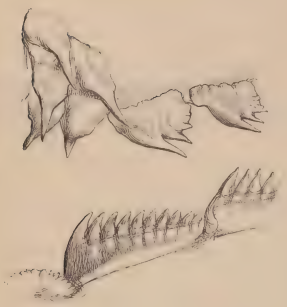
Notidanus.—The only genus, subdivided by Raffinesque into *Hexanchus* and *Heptanchus*, according as the gill-openings are six or seven.

In the year 1846 a specimen of this fish, caught by a fisherman at Polperro, was brought to Jonathan Couch, Esq., who immediately recognised it as the grey sex-branchial Notidanus, and he soon afterwards published an account of it with a figure in the Zoologist (1337).

A specimen had been also taken in the preceding year by Captain Swinburne, and presented to the British Museum, which likewise possesses a portion of the jaw from Dr. Mantell's collection. The origin of the latter is not stated, and the other two are the only instances known of this Shark being taken in the British seas.



The nostril is nearer to the tip of the rounded snout than to the angle of the mouth, and the spout-hole nearer to the first gill-opening than to the eye. The hooked upper front teeth rise from a broad base, and the succeeding seven or eight large teeth are serrated on the outer edge, the first denticle being decidedly the tallest. The front mandibular tooth has lateral serratures, but no middle cusp, and the following five or six broad teeth on each side are equally serrated on the exterior and longer border by from nine to eleven denticles: their thinner inner borders are finely serrated. Dorsal notched on the edge, so placed that the anal commences before the middle of its base, and half-way between the vent and the caudal fin. Pectoral quadrangular, with rounded corners. Anal rounded anteriorly, pointed posteriorly. A distinct under lobe to the



caudal with an obliquely-cut end. Scales entire and very small, leaf-shaped, with a medial keel which reaches to the acute point.—*Müller and Henle.*

Mr. Couch's specimen was two feet two inches and a half long, and was a male with small claspers. Captain Swinburne's fish was about eleven feet in length, and was captured off Ventnor in November 1845. The cuts were all drawn from this specimen.

GRAY NOTIDANUS.

THE PICKED DOG-FISH.

BONE-DOG, *Sussex.*—HOE, *Orkney.*—CU-MAIRE, GOBAG, and BIORACH, *Gaelic.*—CI-PIGOG, *Wales.*

Acanthias vulgaris, RISSO. MÜLLER und HENLE, p. 83.
Galeus acanthias, sive spinax, WILLUGHBY, p. 56, B. 5, f. 1.
Squalus spinax, *Picked Shark*, PENN. Brit. Zool. iii. pl. 133.
,, *acanthias*, ,, ,, DONOV. Brit. Fish. pl. 82.
Spinax ,, *Common Dog-fish*, FLEM. Brit. An. p. 166.
Squalus ,, *Picked Dog-fish*, JENYNS, Man. Brit. Vert. p. 505.
Spinax ,, THOMPS. Nat. Hist. of Irel. iii. p. 254.

SPINACIDÆ. *Family Characters.*—Sharks with spout-holes and two dorsals, each commencing with a strong spine: no anal and no nictitating membrane. All the five stigmata before the pectorals. Intestinal valve spiral.

ACANTHIAS. *Generic Characters.*—Head flat, with large depressions at the corners of the mouth; and two labial cartilages above, one below. Orifice of the mouth flatly arched. Spout-holes large, behind and somewhat above the eyes, with a swollen lappet on their front edge. Orbits long. Teeth incisorial above and below, with a nearly horizontal edge and a point inclined laterally: the roots of the teeth are keeled longitudinally on the inside, and are higher there than on the outside. The first dorsal stands between the pectorals and ventrals; the second between the ventrals and caudal. In the caudal the upper lobe is the largest. In some species there is a caudal pit. The males have a movable, slightly-curved prickle on the outside of the claspers at the tip. Scales shaped like the heart on cards, with a median point and one or more keels.

THE PICKED DOG-FISH is a very common species, at once distinguished from the other British Sharks by the single spine placed in advance of each of its two dorsal fins,—a weapon from which it derives its specific appel-

lation, pick being synonymous with pike or spike. Among the Orkney Islands, where it is called the Hoe, it appears most numerous at the full and change of the moon, on account of the then greater quantity of water, and consequent increased strength or race of the tide in some of the narrow straits. Being gregarious, it frequently makes its appearance in such sculls that the fishermen load their boats to the water's edge with them; and, according to Mr. Low, they prove a valuable capture. The flesh is dried and eaten: the livers yield a large quantity of oil, while their intestines and other refuse parts are strewed over the land as manure. Dr. Neill and Dr. Parnell say this species is very common in the Forth during the Herring season, where numbers are caught; but their flesh is not eaten in that neighbourhood. The Dog-fish is common also at Berwick, and on the north-eastern coast generally.

The Picked Dog-fish is found in numbers at most of the fishing-stations along the south-eastern coast, round to Kent and Sussex, where it is almost universally called the Bone-Dog. According to Montagu's MS. it is very numerous in Devonshire and in Cornwall. Mr. Couch says, "It is the most abundant of the Sharks, and is sometimes found in incalculable numbers, to the no small annoyance of the fishermen, whose hooks they cut from the lines in rapid succession. I have heard of twenty thousand taken in a seau at one time; and such is the strength of instinct, that little creatures not exceeding six inches in length may be found, in company with the larger and stronger, following sculls of fish, on which at that time it is impossible they should be able to prey. The Picked Dog bends itself into the form of a bow for the purpose of using its spines, and by a sudden motion causes them to spring asunder in opposite directions:

and so accurately is this intention effected, that if a finger be placed on its head, it will strike it without piercing its own skin." In March 1858, the newspapers reported a prodigious scull of Dog-fish reaching westward to Uig, from whence it extended from twenty to thirty miles seaward, and in an unbroken phalanx eastward to Moray, Banff, and Aberdeen. These Sharks were then floating in myriads on the surface of every harbour and bay on the north of Scotland. Mr. Peach says that they were numerous in the harbours and rivers of that quarter in the winter of 1857–58, and that as the summer of 1858 advanced, they were very injurious to the Herring fisheries.

This fish is subject, like many others, to occasional monstrosity. A friend of mine was in possession of a Picked Dog-fish with two heads, the separation continuing so far back as behind the pectoral fins. The fishermen who found it informed me that there was only one egg attached to it, and that it must have been dropped from the mother after she was taken. Another curious monstrosity was mentioned to me by the Rev. J. G. Nelson, of Winterton Rectory, Yarmouth. In this, the eyes were on the ventral surface of the head, before the mouth, and were not visible when the fish was laid on its belly. The young are produced at various periods from June to November. This species is common on the coasts of Ireland.

The whole length of the specimen described was eighteen inches; the top of the head is flat; the spout-holes large, and visible from above: first dorsal fin commencing at one-third of the whole length and rather small, convex in front, concave behind; the spine half as high as the fin. The second dorsal fin stands half-way between the first and the end of the caudal, is small, and has a spine

as high as itself: the nose is rather pointed; the eyes lateral, horizontally elongated. Spout-holes large, behind and above the line of the eye; nostrils small, with a minute valve. Mouth semicircular, and when quite open, nearly round; the teeth are low, even and transverse, with their points inclined outwards on each side, and their edges sharp. The pectoral fins are large, and commence half-way between the snout and the first dorsal, while the ventral fins are small, and are placed between the first and second dorsal; there is no anal fin. The tail is powerful, with a broad upper lobe. The upper parts of the head, body, and fins, are slate-grey; the under parts yellowish-white; young specimens generally exhibit a few white spots. Skin moderately rough on passing the finger towards the head, but in the contrary direction it feels quite smooth.

THE TUMMEL AT BONSKIED.

VALENTIN'S SEA-HOUND.

Scymnus lichia, Müller und Henle, Plagiost. 92.

Scymnidæ. *Family Characters.*—Sharks having spout-holes and two dorsals without spines: no anal fin, and no nictitating membrane. Five stigmata, all of them before the pectorals. A spiral intestinal valve.

Scymnus. *Generic Characters.*—Head flat or laterally compressed. Spout-holes far behind and rather above the eyes. All the teeth of the upper jaw straight or vertical to the jaw, slender, hooked: the under teeth broader, with an upright or horizontal cutting edge. Stigmata small, the last two moderately approximated. No caudal pit.

In the sub-genus *Scymnus* the teeth are lancet-shaped on the mandible, sharp on the sides, tumid on the front surface, and have their lancet-shaped tips raised on an elevated base: the mesial mandibular tooth is not smaller than its neighbours, and has the basis alike on both sides, with a notch at the origin of the root. The rest of the mandibular teeth have an impress on the inner side formed by the overlying root of the next tooth. Their roots are bilobate, with a furrow. There is no prickle in the claspers.

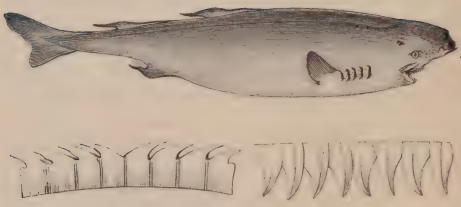
This Shark occurs in Mr. Yarrell's list of new British Fishes intended for his third edition, but without any intimation of the time or place of its capture. As it is a species which inhabits the Mediterranean and the Bay of Biscay, and may be expected to enter the British Channel occasionally at least, a notice of it is given for the benefit of practical ichthyologists. The following description is quoted from Müller and Henle:—

"The nostrils are near the end of the snout, and have a small three-sided lappet on their inner border, and the hinder angle of the eye is over the corner of the mouth. Mandibular teeth serrated, fifteen in number, with two rows erected. The pectorals are round, without a hinder corner; the ventrals four-cornered and broader than the pectorals. Between the pectorals and ventrals, and rather nearer the pectorals, stands the small first dorsal,

rounded, and without a hinder angle. The second dorsal is larger, four-cornered, and is situated immediately behind the ventrals; it is notched in its upper border, blunt at its fore corner, and pointed behind. Caudal fin destitute of an under lobe, three-cornered. Scales having three or more points on a four-cornered base, with three keels on the fore part. Colour violet-blackish or brownish, uniform, but with some black clouds posteriorly."

LOCH LONG, NEAR THE ENTRANCE OF LOCH GOIL.

There floated Haco's banner trim,
Above Norweyan warriors grim,
Savage of heart, and large of limb;
Threatening both continent and isle,
Bute, Arran, Cunningham, and Kyle.
SCOTT.



THE GREENLAND SHARK.

Laemargus borealis, Müll. und Henle, Plagiost. p. 93.
Scymnus ,, *Greenland Shark*, Flem. Brit. An. p. 166, sp. 11.
Squalus ,, ,, ,, Scoresby, Arct. Reg. i. 538, pl. 15.
,, ,, ,, ,, Jenyns, Man. Brit. Vert. p. 506.
Carcharias Haa-skierding, Gunner, Dronth. ii. t. x. xi.

Laemargus. *Generic Characters.* — Head flat or laterally compressed. Spout-holes far back and rather above the line of the eyes. No caudal pit. Upper cutaneous fold at the corner of the mouth very thick, naked; under one very small. Upper teeth slender, conical, feebly incisorial, without serratures; the front pair straight, the others inclined laterally; their roots notched with a perpendicular basal keel in front. On the mandible the teeth are much broader and longer, with a recumbent edge and point inclined laterally, as in *Acanthias*, without serratures, and having a long flat root, a perpendicular keel in front, and concave sides. Male claspers furnished with a prickle.

This species of Shark, which is a native of the Northern Seas, has been several times noticed in Scotland. According to Dr. Fleming, one was caught in the Pentland Frith in 1803; and another, measuring thirteen feet and a half long, was found dead at Burra Frith, Unst, and was seen by Mr. Edmonston.

Ichthyologists are indebted to J. Hutchinson, Esq., of

Durham, for the knowledge that an example of this species was taken on the neighbouring coast in April 1840, and has been preserved in the Durham University Museum. Mr. Hutchinson's very obliging communication contained various interesting particulars, with a sketch of the fish, the fins, the teeth, and the spinous asperities on the skin, to be hereafter noticed in the description. Dr. Baikie mentions the capture of one of these Sharks among the Zetland Islands, and the Rev. J. Smith, of Monquhiter, states in the Zoologist (3057) that another nearly fourteen feet long was taken entangled in some cod lines off Trouphead, in May 1849. The jaws, mouth, and parts of the skin of the latter were sent to the Museum of the University of Edinburgh.

This Shark appears to be well known to several Northern zoologists; and the following account is derived from the valuable work on the Arctic Regions by Captain W. Scoresby.

"The *Squalus borealis* is twelve or fourteen feet in length, sometimes more, and six or eight feet in circumference. The opening of the mouth, which extends nearly across the lower part of the head, is from twenty-one to twenty-four inches in width. The teeth are serrated in one jaw, and lancet-shaped and denticulated in the other. It is without the anal fin, but has the temporal opening; the spiracles (stigmata) on the neck are five in number on each side. The colour is cinereous grey. The irides are blue, the pupil emerald green."

"This Shark is one of the foes of the Whale. It bites it and annoys it while living, and feeds on it when dead. It scoops hemispherical pieces out of its body, nearly as big as a person's head; and continues scooping and gorging lump after lump, until the whole cavity of its belly is filled. It is so insensible of pain, that though it has

been run through the body with a knife and escaped, yet, after a while, I have seen it return to banquet again on the Whale, at the very spot where it received its wounds. The heart is very small; it performs six or eight pulsations in a minute, and continues beating for some hours after being taken out of the body. The body, also, though separated into any number of parts, gives evidence of life for a similar length of time. It is therefore extremely difficult to kill, and it is actually unsafe to trust the hand in its mouth, though the head be separated from the body. Whale-fishers frequently slip into the water where these Sharks abound, yet there has been no instance, that I have heard of, of their ever having been attacked by the Shark."

"Besides dead Whales, the Sharks feed on small fishes and crabs. A fish, in size and form resembling a Whiting, was found in the stomach of one that I killed; but the process of digestion had gone so far, that its species could not be satisfactorily discovered. In swimming, the tail only is used: the rest of its fins being spread out to balance it, are never observed in motion but when some change of direction is required.

"To the posterior edge of the pupil of the eye is attached a white vermiform substance, one or two inches in length. Each extremity of it consists of two filaments, but the central part is single. The sailors imagine this Shark is blind, because it pays not the least attention to the presence of a man; and it is, indeed, so apparently stupid, that it never draws back when a blow is aimed at it with a knife or lance."—*Scoresby's Arctic Regions.*

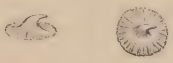
The eyes of the Greenland Shark, with the appendages, were brought home by Captain W. Scoresby, preserved in spirits, and submitted to Sir David Brewster, who gave one specimen to Dr. Grant. The appendage proved

to be a new species of parasitic animal, which Dr. Grant named *Lernæa elongata*, and described it, adding a figure of it, in the seventh volume of the Edinburgh Journal of Science. The imperfection of the vision of the fish was probably produced by the various perforations made in the cornea by the tentacula of this new species of *Lernæa;* as it is by those organs that these parasitic animals retain their hold and live upon the fluids extracted from the part to which they adhere. This *Lernæa*, being perhaps the largest known, measured three inches in length.

A Shark of this species is the subject of a memoir by M. Valenciennes in the first volume of the *Nouvelles Annales du Muséum*, where, on account of the very small size of its fins, it is called *Scymnus micropterus*. This example was found stranded on the sand in the large bay at the mouth of the Seine, about the end of March or the beginning of April 1832. It was bought, and afterwards exhibited at Havre, and was finally sent to Paris, very well preserved, considering its bulk, in a large wooden box saturated with pyroligneous acid. The whole length was thirteen feet. The head and body compressed; numerous mucous pores, arranged in lines, about the head and neck; the body deepest in the region of the pectoral fin; the first dorsal fin smaller than the pectoral fin, and preceded by an elongated ridge or keel on the back of the fish, formed by a fold or duplicature of the skin; the second dorsal fin preceded by a shorter keel: the fish was a male; the ventral fins and sexual appendages, or claspers, very small; no anal fin; the colour dark brown on the back, grey on the belly.

No doubt exists that this species lives in the northern seas, from agreement in dentition with preserved parts of

a large Shark brought from North Cape, and also with the fish described and figured by Gunner in the second volume of the Natural History Memoirs of Drontheim, p. 330, plates X. and XI., under the name of *Squalus Carcharias*. Fabricius, in his *Fauna Groenlandica*, as has already been remarked, quotes Gunner's figure as a representation of his *Squalus Carcharias*, but his description of the pectorals as being very large cannot apply to this species, neither can the extremely long upper lobe of the caudal, and an accurate observer like him would not have overlooked the peculiar dentition of the Greenland Shark, had it been that species he was describing. M. Blainville calls this species in the Faune Française *Norwegianus*. Mr. Hutchinson, referring to the Durham specimen, particularly mentions, and shows in his drawing, the small size of the fins, which accounts for the sluggish movements of the fish as described by Captain Scoresby. Mr. Hutchinson says the colour of the fish when fresh was brown, deeply shaded with blue; the blue soon faded, and it became dark brown; when quite dry, it was cinereous brown. The rows of teeth vary in number from two to six, probably depending upon the age of the fish; the outer row only in each jaw is figured on page 524, that the form might be more clearly defined, those on the left being from the lower jaw. The cusps in all the rows of each jaw diverge from the centre as in the single row of each represented under the fish.



THE SPINOUS SHARK.

Echinorhinus spinosus, Blainville, Faun. Franç. Poiss. p. 66.
,, ,, Müll. und Henle, p. 96.
,, *obesus*, Dr. A. Smith, Zool. South Afr. pl. 1, male.
Goniodus spinosus, Agassiz, Récherches sur les Poiss. Foss., the teeth.

Echinorhinus. *Generic Characters.*—Head flat, pits at the corner of the mouth broad: tongue adherent. Teeth alike in both jaws, broad and low, with a nearly horizontal cutting edge: on their sides, from one to three horizontal denticles. On the mandible, a mesial vacuity in which there is a very small pyramidal mesial tooth. First dorsal standing over the ventrals, the second between these fins and the caudal. No under caudal lobe. Stigmata not very large, all before the pectorals.

In July 1836, when the publication of the first edition of the British Fishes was nearly complete, Mr. John Hey, then Honorary Curator to the Leeds Philosophical Society, sent a coloured drawing of the well-known Spinous Shark of authors, of which a specimen had been taken in Filey Bay, on the Yorkshire coast, in the summer of 1830. On the 30th of the same month a letter received from Dr. H. S. Boase, of Penzance, contained an account of the capture of the same kind of Shark on the 23rd of that month, near the Land's End; accompanied by pen-and-ink sketches of two views of

the Shark, with drawings and specimens of the teeth and spines.

In November 1837, the Rev. Robert Holdsworth transmitted a notice of the capture of a third example of the Spinous Shark, in a trawl-net off Brixham, with pen-and-ink sketches of the form of the body, a small portion of its spine-studded skin, and some of its teeth.

At the meeting of the British Association at Newcastle-upon-Tyne, in August 1838, Arthur Strickland, Esq., of Bridlington, exhibited a drawing, and read a short description, of a Spinous Shark, which had shortly before that date been found on the Yorkshire coast, and was evidently of this species, a reference being made at the time by Dr. Gray to the figure of it published by Dr. Andrew Smith, in the first number of his Illustrations of the Zoology of South Africa, which the drawing exhibited by Mr. Strickland very closely resembled.

On the 9th of November 1838, the Rev. Robert Holdsworth intimated that another specimen of the Spinous Shark had been caught on a fisherman's line off Berry Head on the previous Tuesday, and soon afterwards the same event was notified by Mr. Couch, of Polperro, and Mr. Heggerty, of Torquay. On December the 6th, 1849, one of these Sharks was captured in

Mrs. Chard's trawl-net off Falmouth Harbour. A well-executed sketch of this specimen by W. P. Cocks, Esq., has a near resemblance to the figure at the bottom of the preceding page.

In addition to these six instances of the capture of this Shark on the coast of England, the pages of the Zoologist (3057) mention that a dead one was cast ashore on the rocks of Gamrie, in the Moray Frith, on the 1st of January 1851.

This very remarkable Shark was first described by Broussonnet under the name of *Le chien de mer bouclé*, in the *Mémoires de l'Académie des Sciences pour* 1780; and it is a species that is exceedingly well known, having a wide geographical range, extending from the North Sea to the Cape of Good Hope in one direction, and from the shores of Italy into the Atlantic in another. The specimen described by Broussonnet measured only about four feet in length; but it has been taken upwards of seven feet long on the Cornish coast; and M. Risso mentions that one of four hundred pounds' weight, and therefore probably still longer than the Cornish specimen, was caught by the Mandrague, or Tonnaro fishermen of Nice, in the horizontal nets set up by them to catch Tunnies.

Some differences will be observed in the comparative length and thickness of the figures here given, the first of which is taken from the drawing by Mr. John Hey of the Filey Bay specimen; the second, placed at the foot of the preceding page, representing a more bulky fish, is copied from Dr. A. Smith's illustrations. The figures given by Lacépède and the Prince of Musignano are rather long and slender, and were probably done from specimens of small comparative size; the figure sent by Dr. Boase, of a fish more than seven feet long, and

the drawing exhibited by Mr. Strickland at Newcastle, more resembled the figure by Dr. Smith. Some specimens are described as being intermediate, and all these differences in the same species may be referred to age or sex, or to both, a young male and an old female presenting the greatest contrast. The decided similarity in the teeth, which are very peculiar, and only differ in size, added to the particular character of the skin and its spines, with their radiated bases, leave no room to doubt that these various examples belong to one and the same species.

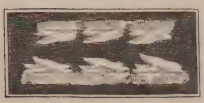
We become acquainted with some of the habits of this Shark by noticing the circumstances under which it has been captured. Of the first Cornish specimen Dr. Boase says, it was caught on the 23rd of July 1836, west of the Long Slips, Land's End. Just before the moon set the fishermen had been very successful, but all at once lost their sport, or as they expressed it, "the Congers suddenly sheered off to a man." When hooked, it was not at first more troublesome than a Conger; but when brought to the water's edge, it gave battle, and was secured with great difficulty. The first specimen noticed by the Rev. Robert Holdsworth as caught in a trawl-net off Brixham, had a portion of a Gurnard in its stomach. Of the third specimen, caught on the southern coast, near Berry Head, Mr. Holdsworth says, this Shark was taken near the bottom by a hook baited with cuttle, and set for Conger Eel, and other large fish. They described his action in the water as most powerful, and were obliged to let him run with the line four times to the bottom before they could hamper him with a sliding noose let down over the line to his tail. These lines and the trawl-net only do their work at the bottom, and we may, therefore, conclude that this species is a Ground Shark. As such,

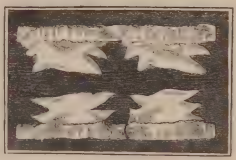
Cuvier had arranged it in his genus *Scymnus* (of which *Laemargus* of Müller and Henle is a sub-genus); and Dr. Andrew Smith, who from his extensive acquaintance with this division of the cartilaginous fishes is an admitted authority, confirms this opinion. Of the Spinous Shark, Dr. Smith says, "This species is comparatively rare at the Cape of Good Hope; and is described by the fishermen as sluggish and unwieldy in its movements, and as seldom rising towards the surface of the water. They obtain specimens, generally when they are fishing in deep water, and the bait with which the hooks are armed is near to the bottom. In this respect the Spinous Shark resembles the *Scyllia*, or Ground Sharks; and, if we were to regard only its internal organization, we should be disposed to consider it as closely allied to that genus." Never having seen a specimen of this Shark, the following description of its colour and form is derived from Dr. Smith's work.

Colour:—The head and back, as far as the first dorsal fin, dark leaden grey; the rest of the back, the sides, and the belly, pale coppery yellow, clouded with purple and brownish tints, and marked besides with blotches of light vermilion-red; the fins towards their bases are reddish-brown, tinged with dull grey, but towards their extremities a lighter shade of the same colour prevails; chin, sides of muzzle, and sometimes a spot behind the eye, dull white; eyes coppery green.

Form, &c.—Body very thick in proportion to its length, with only a slight diminution in size towards the tail; the back in front of the first dorsal fin nearly straight; the head flat above, and slightly sloping to the muzzle, which is rounded; nostrils transverse, and each partially divided by a narrow membranous lobule, which projects backwards from its anterior margin; their posi-

tion is nearly over the symphysis of the upper jaw, considerably nearer to the eyes than to the tip of the snout, and about half-way between the latter, and the angle of the mouth. Eyes rather nearer to a line raised from the angle of the mouth than to the nostrils; pupil circular and small; postocular spiracle scarcely visible. Gape wide and arched, having at each corner a triangular fold of skin formed by the union of the upper and lower lips. Teeth regularly placed upon each jaw, only one row in use at a time, the rest reclined; they are large, compressed, and somewhat quadrangular, the cutting edges nearly horizontal, and both of their sides are generally bicuspid, as will be seen by the figures here inserted, representing from young and old specimens the teeth of both jaws as opposed to each other.

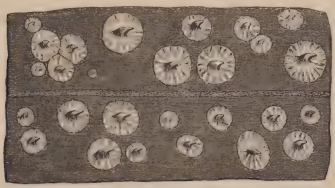


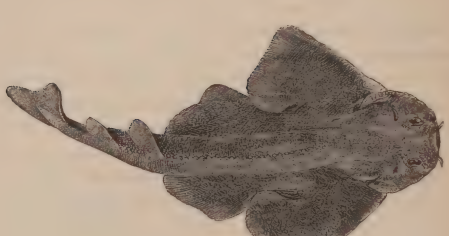


Branchial openings all in front of the pectoral fins; the first not more than half the length of the fifth. Pectoral fins rather small, the hinder edges nearly square; the dorsal fins are small, and the first is narrower at its base than at its extremity, which is slightly rounded; the second is nearly throughout of equal breadth, with the hinder edge almost square; the ventral fins short, broader behind than at their bases, and their posterior edges slightly undulated; the caudal fin entire, somewhat triangular, and slightly falciform; the upper portion high

above the line of the back, the lower scarcely below the line of the body immediately in front of it. Lateral line distinct, commencing above the branchial openings, and extending nearly, without curve or undulation, to the commencement of the caudal fin, from thence it ascends the latter, and extends along it, nearer to its anterior than posterior edge, until it reaches its upper extremity; at its origin this line is nearer to the middle of the back than to the base of the pectoral fin; to the touch it feels slightly rough, owing to its being beset with a number of minute prickles, which are most distinctly seen in stuffed specimens. The surface of the skin both on the body and fins is more or less sprinkled with strong bony-looking spines, with large circular and flattened bases, which are striated from the centre towards the circumference. These spines vary in size as well as form, some being hooked, others quite straight; in some places they are disposed in clusters, in others they are solitary, and on the extremity of the muzzle are nearly wanting. The appendages to the ventral fins in the male seldom extend much beyond their posterior margins.

According to M. Risso, the females of this species have a smaller number of these spines than the males.





THE ANGEL FISH.

MONK-FISH, SHARK-RAY, AND KINGSTON.—MAELGI, *Wales.*

Squatina angelus, Dumeril. Cuvier, Règne Anim. t. ii. p. 394.
,, ,, *Monk, or Angel-fish*, Willughby, p. 79, D. 3.
Angel-fish, Borlase, Cornw. pl. xxvi. f. 5.
Squalus squatina, *Angel Shark*, Penn. Brit. Zool. vol. iii. p. 130, pl. 15, male.
,, ,, ,, ,, Donov. Brit. Fish. pl. 17.
Squatina vulgaris, *Monk-fish*, Flem. Müll. und Henle, p. 100.
,, *angelus*, *Angel-fish*, Jenyns, Man. Brit. Vert. p. 507.

Squatinædæ. *Family Characters.*—Body depressed, flat on both dorsal and ventral surfaces: eyes on the dorsal aspect; mouth at the extremity of the snout. Spout-holes large, behind the eyes. The large pectorals, expanded anteriorly to the sides of the head, are separated from it on each side by a slit, in the depth of which the closely-approximating stigmata are ensconced. No anal fin.

Squatina. *Generic Characters.*—Spout-holes larger than the eyes, crescentic. The nostrils, with a long exterior tag to each, lie under the edge of a broad superior lip: on their inner sides there are small divided tags. Teeth conical, with interspaces. Both dorsal fins stand on the tail, which is broader than it is high, and has a cutaneous keel on each side. The under lobe of the caudal fin is the longest, and the upper one is without a notch. Ventrals large. Male claspers small and soft. Scales scattered, conical, with a terminal point.

This fish, certainly more remarkable for the singularity of its form than for its beauty, is called Angel-fish in England, France, and Italy, and is said to have acquired that name from the expanded pectoral fins having the appearance of wings: it is also called Monk-fish, because its rounded head looks as if enveloped in a monk's hood. Mr. Donovan says the form of its body has obtained for it in some places the name of Fiddle-fish; and it is also called Shark-Ray, from its partaking of the characters of both Shark and Ray, though in some respects distinct from either. It is, however, by no means so truly a link between those families as the exotic genus *Rhinobatus*.

It is most numerous on the southern coast of our island; but is occasionally taken in the Forth, and some other parts of the east coast, particularly about Cromer and Yarmouth. It is common on the coasts of Hampshire, Kent and Sussex, where it is called a Kingston,—a name for it that occurs in Merrett's Pinax. It is also taken in Cornwall; and is recorded as occurring in Ireland on the coasts of Kerry, Waterford, Dublin, and Belfast. Mr. Thompson preserved notes of five instances of its capture in Belfast Bay: and Mr. A. Norman says in the Zoologist (5366), that it is by no means uncommon in the Frith of Clyde, but Dr. Baikie states that it is rare among the Orkneys.

This fish is very voracious, and feeds on the smaller flat-fishes, which, like itself, swim close to the bottom; occasionally, like them also, hiding itself in the loose, soft soil that floats over it. The Angel-fish sometimes attains a large size. Cuvier, Pennant, and others, mention having seen specimens that would have weighed one hundred pounds. The flesh is now considered indifferent and seldom eaten, but is said to have been formerly held

in high estimation. The skin is rather rough, and is used for polishing, and other works in the arts: Mr. Donovan also says that the Turks at the present time make shagreen of it.

A second species of this genus has been supposed to occur on our coast; but the Angel-fish is probably liable to some variation in colour, depending on the nature of the ground in the locality in which it is found: the sexes also exhibit some differences. The females produce their young alive in June.

This species is said to attain the length of seven or eight feet; the specimen described measured but fourteen inches in length; and in breadth across the pectoral fins seven inches and a half; eyes distant from one another one inch and a quarter; temporal orifices very large, one inch and a half apart, elongated transversely, about as far behind the eyes as these are from the anterior margin of the head; sides of the body of the fish parallel behind their free edges; ventral fins elongated, slightly rounded, contracted in breadth behind; commencement of first dorsal fin even with the posterior edge of the ventrals. The mouth is very wide, opening on the anterior margin of the head, and the angles of the mouth are under the external angles of the spout-holes: teeth long and pointed; branchial stigmata elongated; the parallelism of the sides of the fish is most conspicuous on the ventral aspect; the anal orifice is rather before the middle of the whole length. The under parts smooth and of a soiled white colour; all the upper surface granulated, rough, of a dark mottled chocolate-brown; a row of short spines, pointing backwards, is ranged along the central line of the back between the ventral fins.

THE OLD BRITISH TORPEDO.

COMMON CRAMP-FISH, NUMB-FISH.—SWRTHBYSG, *Wales.*

Torpedo marmorata,	Risso. Müller und Henle, p. 128.
Torpille,	Duhamel, Sect. ix. pl. 13.
Torpedo,	Walsh, Phil. Trans. 1772, vol. lxiii. p. 480, figs. 1–3.
Raia Torpedo,	*Electric Ray,* Penn. Brit. Zool. vol. iii. p. 118, pl. 12.
Torpedo diversicolor,	Davy, Researches, i. p. 79.
,, *vulgaris,*	*Common Cramp-fish,* Flem. Brit. An. p. 169.

Torpedinidæ. *Family Characters.*—Disk roundish, naked and without scales or prickles. Ventrals immediately behind the pectorals. Tail short, fleshy, depressed at the base, cylindrical towards the end, keeled on the sides, with two, one, or no dorsal, and a terminal three-cornered caudal fin. Upper eyelid adnate, without a mesial projection. The nasal lappets, on both sides, are attached to a four-sided flap, with a free edge, but connected by a bridle to the upper lip, so as to leave the lateral corner of the nostril open. Teeth cuspidate or flat. A galvanic battery occupies a large space bounded by the skull, gills, and pectorals.

Torpedo. *Generic Characters.*—Two dorsals. Disk roundish, truncated in front transversely, or in an inverted arc. Mouth crescentic. Teeth cus-

pidate, with a transverse base attached to a jaw cartilage, and not extending outwards over the edge of the mouth. Spout-holes fringed, distant from the eyes. Ventrals rounded. Two dorsals, of which the first is the largest, and stands over the hinder part of the ventrals: the second is situated midway between the first and the caudal fin. Caudal three-cornered, with an almost straight terminal edge.

The second division of the PLAGIOSTOMES, named by Müller and Henle the ROCHEN or RALE, are flatly-depressed, laterally-expanded fish, furnished with spout-holes and five branchial orifices or stigmata on the ventral aspect: adnate eyelids, or none, and a complete, strong, cartilaginous scapular arch with a cephalic-fin cartilage. The *Torpedinidæ* are the third family of Rays in the arrangement of the ichthyologists that have just been named.

THE earliest notices of the Torpedo on our coasts by English writers were made by Smith in his History of Waterford, and afterwards by Pennant and Walsh; but as, according to Baron Cuvier, several species have been included under the name of the *Raia Torpedo* of Linnæus, the true name of one of the British species is still doubtful, and it remains therefore for some naturalist who is fortunate enough to obtain British specimens to determine the particular species of our coast.

Colonel Montagu, in his MS. notes, mentions having met with two examples of the Torpedo; but gives no description of either of them. The first was of small size, and was taken at Torcross, where it was so rare as to be unknown to the oldest of the fishermen of that place. Of the second, the notice is as follows:—"I observed a very large specimen that was taken on a turbot-hook off the coast of Tenby, in Wales. It was dead when disengaged from the hook, or the fisherman would certainly have had a shock that would have made him remember the species again. It appeared, however, to be so rare here, that no one knew the fish, and it was exhibited as an extraordinary creature. Its weight was about one hundred pounds."

The figure at the head of this subject was taken from

a small specimen which appears to be of the same species as that figured by Pennant in the British Zoology; but Pennant's plate, which exhibits in the two outside figures the under and upper surface of a female, the third and middle figure being that of a male of smaller size, appears to have been copied from a larger print representing specimens taken on the sea-shore in the neighbourhood of La Rochelle. Mr. Donovan's figure differs from that of Pennant in exhibiting a marbled appearance on its upper surface, with five distinct dark spots: it differs also in its form and proportions, and is referred by Müller and Henle to the *Torpedo oculata* of Belon, but they say that it is a marbled variety which they have not seen. The round black spots of this Mediterranean Torpedo vary in number from one to five, and are sometimes imperceptible, at least in specimens preserved in spirits.

The electrical powers of the Torpedo are so well understood by the different names that have been applied to it, as well as by the various and voluminous accounts that have been published, that it is unnecessary to repeat here what has already appeared so often in print elsewhere. The situation of the apparatus or structure from which these species derive their extraordinary power is between the eyes and spout-holes and the curved bases of the pectoral fins, occupying the whole depth between the upper and under surfaces of the body. It is composed, as shown by the figures of Walsh and Pennant, of a great number of cylinders arranged perpendicularly to the plane of the upper and under surfaces, and presents in a transverse section very much the appearance of a cut honeycomb. The cylinders contain a mucous secretion, and the structure is largely provided with nerves derived from the eighth pair. It is said that when the shock is given, the convex part of the upper surface is

gradually depressed, the sensation is then felt, and the convexity suddenly returns.

All the uses of the electrical apparatus can only be conjectured. That it serves as an instrument of defence is very probable; that it also enables a slow, inactive fish to arrest and obtain as food some of the more active inhabitants of the deep, is also probable. Mr. Couch thinks other powers may emanate from it, and his opinion is thus expressed:—"One well-known effect of the electric shock is to deprive animals killed by it of their organic irritability,* and consequently to render them more readily disposed to pass into a state of decomposition, in which condition the digestive powers more speedily and effectually act upon them. If any creature more than others might seem to require such a preparation of its food, it is the Cramp-Ray, the whole canal of whose intestine is not more than half as long as the stomach." "So long ago as the time of Dioscorides, the physician of Anthony and Cleopatra, the shock of this fish was recommended for medical purposes, and especially for pains of the head; and this may be considered as the earliest record of the application of electricity to medicine. In later times, it was applied to the cure of gout; the patient being directed to keep his foot on the fish until the numbness extended to the knees. Baron Humboldt remarks, that the will of the fish directs the effect to whatever part it feels most strongly irritated, but only under the influence of the brain and heart. When a fish was cut through the middle, the fore part of the body alone gave shocks."—*Couch.*

But few of the Torpedo's habits are known: it is said to prefer soft and muddy ground, where its actions are

* The bodies of animals killed by lightning do not become stiff, and decomposition goes on rapidly.

slow and inert. It is rare on the British coast; but two or three species inhabit the Mediterranean, and there is reason to believe that two species inhabit our seas. Walsh obtained specimens at Rochelle, and published a figure in the Transactions of the Royal Society for 1773, which exhibits the round and stellated spout-holes, and in 1774 he records the occurrence of the Torpedo in Torbay and Mount's Bay. John Hunter gives a figure with fringed spout-holes in the Philosophical Transactions for 1773, pl. 20. Pennant's figures appear to have been copied from those of Walsh; but Pennant was too good a naturalist to have adopted a figure that did not agree with his specimens; moreover, in his description are the words, "Behind each (eye) was a round spiracle, with six small cutaneous rags on their inner surface." Mr. Donovan's figure exhibits spiracles with fringed edges. The colour was a pale mottled brown. I have assumed, therefore, for distinction's sake, that it may be the *marmorata* of Müller and Henle. The species next to be described has the spiracles oval, with perfectly smooth edges, and has been taken on various parts of our coast.

A NORWAY YAWL.

THE NEW BRITISH TORPEDO.

Torpedo nobiliana, Bonap. Faun. Ital. 1835. Müll. und Henle, p. 129.
,, *Walshii*, Thompson, Ann. Nat. Hist. vol. v. p. 292.
,, ,, ,, Nat. Hist. of Irel. iii. p. 256.
,, *emarginata*, M'Coy, Ann. Nat. Hist. vol. vi. p. 407?

In the month of September 1808, H. Hunt, Esq., of Dartmouth, did me the favour to send me two examples of a Torpedo taken on the coast of Devonshire, and these are the only British-caught specimens I ever possessed. One of them was very large, and was taken in a trawl-net; this fish I presented in Mr. Hunt's name to the Museum of the Zoological Society, and it is now in the collection: the second specimen being smaller and more manageable, I preserved it for myself, and from it the figure here given was drawn.

This species differs from the one represented by Walsh, Pennant, Hunter, Shaw, and Donovan, and also that figured on page 539, in having the temporal spiracles with perfectly smooth edges: but it agrees with the Torpedo caught in July 1840 in one of the weirs at Swansea, and so minutely described by L. W. Dillwyn, Esq., in his Contributions towards a History of Swansea. It agrees also with the *Torpedo Walshii* of William Thompson, Esq., who has seen my specimen, and considers it to be identical with those which have been taken on different parts of the coast of Ireland, most of which are particularly referred to in his paper in the fifth volume of the Annals of Natural History, as already quoted among the synonymes. It is identical also with the *Torpedo emarginata* of Mr. M'Coy, as described and figured in the sixth volume of the Annals of Natural History, pp. 407 and 408.

When looking over my collection of British Rays with C. L. Bonaparte, Prince of Canino, during his visit to London in May 1841, that distinguished naturalist, on seeing the Torpedo, immediately said, "that is the *nobiliana* of my Fauna Italica," and that name is accordingly placed at the head of the synonymes, there being little doubt of the identity of the Mediterranean fish with our New British Torpedo. The figure in the Fauna Italica exhibits the double emargination on the anterior edge at the junction of the pectoral fins with the head, as shown and described by Mr. M'Coy, in his communication to the Annals of Natural History; but it does not place the anterior dorsal fin entirely behind the ventrals.

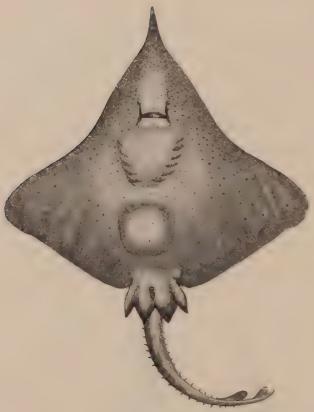
Several specimens of Torpedo, besides those already mentioned, have been taken at various times on different parts of our coast, particularly in Devonshire, Cornwall,

South Wales, and the south of Ireland; but their peculiarities were either unnoticed or unrecorded, and it is therefore doubtful to which of our species they belonged. Some naturalists may still consider that we have but one species, and that the present fish is identical with that of Walsh and Pennant. Montagu, unfortunately, did not describe or particularise either of the two specimens he saw, but it may be concluded that he would have done so, had either of his examples differed from the figure and description given by Pennant. The New British Torpedo appears to vary in its colour from a reddish-brown to a dark greenish or bluish black; it remains to be shown whether the smooth uninterrupted margin of the spiracles may be depended upon as a permanent specific character. Excellent descriptions of the New Torpedo have been given by Mr. Dillwyn and Mr. Thompson in the volumes quoted, and a single specimen may decide the question.

The whole length of the fish from which the figure was taken is twenty-six inches; the greatest breadth fifteen inches and a quarter; the length to the posterior free margin of the pectoral fins thirteen inches and a half; the base of the first dorsal fin occupies the central line of the lower third portion of the ventral fins; the second dorsal fin is placed half-way between the posterior edge of the first dorsal fin and the commencement of the upper lobe of the tail; the second dorsal fin is of the same shape, but only half as large as the first dorsal fin; the upper and under lobes of the tail, forming together the caudal fin, are nearly equal in size, and somewhat triangular in shape; the posterior free margin but slightly concave in the centre; the eyes small, the spiracles perfectly smooth at the edge, not in the least serrated, and rather oval in shape than circular, but this form may have

been produced while the skin was drying; teeth small, numerous, and pointed, calculated for holding rather than for cutting, the form being that of a sharp incurved spine issuing from a broad base; the mouth wide; the colour on the upper surface of the body and fins a uniform dark chocolate-brown tinged with dark bluish-black; the under surface white, but while the fish is fresh, the belly is said by observers to have over it a blush of red. The specimen was a female. The males have long cylindrical claspers on the inner edge of the ventral fins.

LATINE-SAILED BOAT—LAKE OF GENEVA.



THE LONG-NOSED SKATE.

Raia vomer, Fries, Skandinav. Fiskar.
,, ,, Müller und Henle, Plagiost. 144.
Chagreen Ray, Yarrell, Brit. Fish. 1st Edit. ii. p. 414.

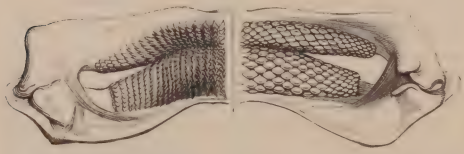
Raiædæ. *Family Characters.*—Disk broad, rhomboidal, the two sides which meet to form the lateral angle being the edges of the pectoral fin, which runs forward on the side of the head flanking the snout, and extends posteriorly to the ventrals. Tail slender, depressed with a lateral keel on each side, supporting the dorsals near its end, but having either no caudal fin, or a mere fold of skin. Spout-holes smooth-edged, separated from the orbits by a narrow bridge. Upper eyelid adnate. Nasal flap four-sided, confluent with the dentiferous edge of the upper jaw, ending laterally in a rounded corner, and more or less deeply fringed. A small ledge bounds the nostril below. Mouth curved, with an upper fringed velum interiorly; no labial cartilages. Teeth pavement-like or cuspidate in the males when spawning, and sharp prickles are then developed on the pectorals. Skin smooth or prickly. Oviparous.

RALÆ. *Generic Characters.*—Snout keeled, with a cuticular space between the keel and the adjoining parallel edge of each pectoral. Ventrals bilobed, the outer lobe thicker and narrower than the inner one. Caudal represented by a cuticular seam, most distinct above, and generally interrupted at the point.

THE RAYS, or Skates, as they are popularly called, are remarkable for the rhomboidal form and consequent breadth of their bodies, contrasted with their long narrow tails, frequently furnished with two and sometimes three small fins, and mostly armed with one or more rows of sharp spines along the whole length. The whole body is very much depressed; and its great breadth is produced by the expansion of the pectoral fins, each of whose bases is equal to the whole length of the body and head. The Skates may almost be considered as having no distinct head or neck, the sides of both being included and thus protected by the expanded anterior margin of each pectoral fin. The nostrils, mouth, branchial and anal apertures, are on the under surface; the eyes and temporal orifices on the upper surface. The texture of the skin of the body varies considerably, and will be referred to when describing the different species. From the peculiar form of the body, admirably adapted to exist at the bottom of the water, the Skate may with more propriety be called a Flatfish than any species of the *Pleuronectidæ*. Their mode of progression is not very easily described: it is, when they are not alarmed, performed with a slight undulating motion of the pectoral fins, something between flying and swimming. I once heard a North-country fisherman call it sluddering. When a Skate makes the best of its way either to gain a prize in the matter of food, or to escape an enemy, great muscular exertion is evident. The mode of defending itself, as described by Mr. Couch, is very effectual: the point of the nose and the base of the tail are bent upwards towards each other;

the upper surface of the body being then concave, the tail is lashed about in all directions over it, and the rows of sharp spines frequently inflict severe wounds.

Some sexual peculiarities require particular notice. The woodcut introduced below represents in the left-hand portion an inside view of one-half of the mouth of an adult male; that on the right, an inside view of one-half of the mouth of an equally adult female of the Thornback Ray. In the young, the teeth of both sexes are alike broad and flat; but as the male acquires age and sexual power, the teeth that are nearest the centre begin to alter in form and become pointed by an elongation of the internal angle, all the points being directed backwards or towards the throat. Some exceptions to this apparent rule will be pointed out.



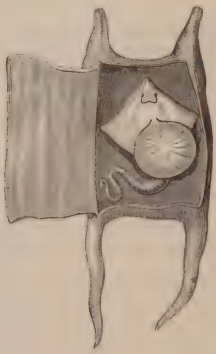
Another sexual peculiarity in which the Skates resemble the Sharks is the cylindrical appendage to each ventral fin in the males. The figure at the head of this subject is taken from the under surface of a female, in which no appendages exist; the figure of the Sharp-nosed Skate (p. 555) is from the upper surface of an old male, and shows appendages lying on each side close to the tail; even in very young specimens, not more than three inches in breadth, the sexes may be determined by the constant existence of these claspers in the males.

The figure of the Blue Skate (p. 560) is taken from the under surface of a young male, and exhibits these appendages of smaller size: their use may be inferred from the name they bear—they are commonly called claspers. The figure of the Sharp-nosed Ray exhibits other peculiarities common to males: these are the clusters of spines outside the eye and temporal orifice on each side, and the regular rows of spines towards the upper outer surface of the pectoral fins. The elongation of the central teeth, the development of the cylindrical appendages, and the appearance and growth of the clusters and rows of spines on the upper surface at the parts pointed out, may be considered analogous to those sexual distinctions which exist in many species of birds and mammals, and which have been called by John Hunter and others, secondary sexual characters. These spines on the upper surface of the males occur in the different species of Skate with smooth skins, as well as in the others, and are entirely independent of the spinous productions of the cuticle which distinguish two British species, and will be more particularly noticed hereafter. It may here be stated generally, that the Skates are very voracious: their food consisting of any sort of fish that they can catch, with mollusks, testaceous or naked, and crustaceans. So powerful are their muscles and jaws, that they are able to crush the strong shell of a crab with ease. As in the Sharks, the females are larger than the males.

The under surface of the Skate at the head of this subject presents two central circular cavities. The upper one just below the transverse mouth is bounded laterally by the five branchial apertures on each outside; within this cavity the gills are placed. The circular cavity below is the abdomen, and contains the stomach, intestines, and other viscera. The heart is placed in the centre

between the two cavities, and is protected by the broad and strong cartilaginous, scapulo-coracoid arch.

The young are produced towards the latter part of spring, or during summer. They are deposited by the parent fish in thin horny cases, like those of some of the Sharks already described; but they are more square in form, as the representation inserted below shows. These horny cases of the Rays, like those of the Sharks, are also called purses; and on the coast of Cumberland bear the name of Skate-barrows, from the resemblance in shape to a four-handed machine by which two men carry goods. As the young Skate increases in size, the angular parts of the body curve over for a time, till the fish ultimately escapes to provide for itself in a much wider but more dangerous region.



The eleven species of true Rays which are found on the coasts of this country will be arranged here in two

divisions; the first of which contains seven species, having the skin perfectly smooth; the second division contains two species with rough skins, and two which are furnished with numerous short sharp spines on various parts of the surface of the body; these lead to three other genera, the species of which are still more powerfully armed with a long spine.

Skates, as food, are held in very different degrees of estimation in different places. In London, particularly, large quantities are consumed, and the flesh is considered delicate and well-flavoured; but on some parts of the coast, though caught in considerable numbers, both by lines and nets, the flesh is seldom devoted to any purpose beyond that of baiting pots for catching crabs and lobsters. Skates are in the best condition for the table during autumn and winter. In spring, and in the early part of summer, they are usually maturing eggs or young, and their flesh is then soft and woolly.

The Long-nosed Skate is immediately distinguished from any other Skate found on the British coast, not only by the great length of the nose, but also by the distance between its most extreme point and the transverse line of the mouth; characters particularly observable in comparison with the species next in order, with which it most assimilates in colour. The snout is very much produced, narrow and sharp, slender as far as the eyes, from whence the body dilates gradually to its greatest breadth, which is behind the centre; the whole length of the body and tail is one-third greater than the width. On the upper surface the body is of a light lead colour; the tail is furnished with a row of crooked spines: the small fins on the tail are not far removed from each other, and the second is about its own length from the end. The under surface is a dirty greyish-white, marked with numerous

mucous pores which look like dusky specks; the body is thin; the nostrils are lobed; the mouth narrow; the teeth in old males sharp: on the snout there are two rows of minute tubercular spines; towards the outer upper edge of the pectoral fins on each side are the usual rows of sharp hooked spines, and close to the tail the long pendent claspers.

According to Mr. Couch, this species frequents deep water, and is not caught during the winter: fishermen say that it is exceeding violent when hooked. It may be generally stated, that the greater part of the Skates brought to market are taken in trawl-nets.

THE SHARP-NOSED RAY.

SKAD-SKACHT, *Scottish Highlands.*—MORCATH DRWYNFAIN, *Wales.*—WHITE SKATE, *Scotland.*—BURTON SKATE, *Cornwall.*

Raia lintea, Huit-rocka, FRIES, Skandinav. Fiskar. pp. 153 and 81.
,, *oxyrhynchus, Sharp-nosed Ray,* MONTAGU, Wern. Mem. ii. p. 423.
,, ,, ,, ,, PENN. Brit. Zool. vol. iii. p. 113.
,, ,, ,, ,, FLEM. Brit. An. p. 171.
,, ,, ,, ,, JENYNS, Man. Brit. Vert. p. 511.

THIS species, says Mr. Couch, from whose drawing the figure is taken, "may be easily recognised by its sharp snout, by the waved line of the margin of the body from the snout to the extremity of the expansion, and by its

pure white colour on the lower surface. It is the largest of the British Rays; for though in length and breadth it may not exceed the common Skate, its superior thickness renders it heavier."

The skin is smooth, with the exception of the spines on the upper surface, peculiar to the males; the colour is plain brown, without spots or lines, and never so dark as that of the Long-nosed Skate, with which it is sometimes confounded. The teeth of the males are longer, more pointed, and sharper than those of other species. The tail is armed with three rows of spines.

Mr. Couch states that the smaller-sized specimens are taken throughout the year; but those which are larger keep in deep water, and are only taken in summer and autumn.

The French are great consumers of Skate, and this species is their favourite fish: their boats come to Plymouth during Lent to purchase Skate, which they preserve fresh and moist during the run back to their own coast, by keeping them covered with wet sand.

This species is the White Skate of the Orkneys, and of Scotland generally, and Mr. White mentions that it also has the names in that country of Friar Skate, May Skate, and Mavis Skate (Catalogue of British Fish in the British Museum).

Dr. George Johnston says it is not uncommon at Berwick, and attains a very large size: this gentleman had measured one which was seven feet nine inches in length, and eight feet three inches in breadth. It is said to have been taken on the south-east coast of Ireland, and off Madeira.

THE FLAPPER SKATE.

Raia intermedia, Parnell.

Raia intermedia, Flapper Skate, Parnell, R. S. E. Proceedings for 1837.
" " " " ., Trans. R. S. E. vol. xiv. pl. 6.
" " " " " Mem. Wern. Nat. Hist. Soc. vii. pl. xl. and xli. var.
" " " " Müller und Henle, Plagiost. p. 147.

"This fish," says Dr. Parnell, "which was obtained in the Frith of Forth in the month of May, seems to be a new species of Skate, since I am not aware of its having been previously described. It appears to be the connecting link between *Raia batis* and *Raia oxyrhynchus*, to both of which it is closely allied, and it is from this circumstance that I suggest the specific name of *intermedia*."

"It is distinguished from *Raia batis*, by the upper surface of the body being perfectly smooth, without granulations, and of a dark olive colour, spotted with white; by the anterior part of each orbit being furnished with a strong spine pointing backwards; by the dorsal fins being more remote from each other, and by the anterior margins of the pectorals being rather more concave, giving the snout a sharper appearance; whereas, in *Raia batis*, the upper surface of the body is rough to the touch, of a uniform dusky grey without spots; the orbits are without spines; the dorsal fins closely approximate, and the anterior margins of the pectorals nearly straight."

"It is likewise removed from *Raia oxyrhynchus*, in the snout being conic, and the under surface of the body dark grey; by having a spine in front of each orbit, and the back of a dark olive-green, spotted with white; whereas in the *Raia oxyrhynchus*, the snout is sharp and long, with the lateral margins parallel near the tip; the under surface of the body pure white, and the back of a plain brown without spots."

This species is not uncommon in the Frith of Forth, and "I have met," observes Dr. Parnell, "with two examples of a variety of this fish which were taken in the salmon-nets at Queensferry. They were both of small size, about eighteen inches in length. The back was of a uniform dark olive-green without spots of any description, covered with a thick mucus; under surface of a dark grey; body very thin; snout sharp, conical; pectorals at their anterior margin rather sinuous, passing off somewhat suddenly at that part, in a line with the temporal orifices, giving the outline of the anterior part quite a different appearance to that observed in *Raia intermedia*: the anterior part of each orbit is furnished with a spine; back perfectly smooth; tail with one row of spines on

the dorsal ridge; fins, and in all other respects, similar to *Raia intermedia*."

A female specimen of the Flapper Skate, about two feet in length, tail included, is thus described by Dr. Parnell:— "Body rhomboidal, the transverse diameter equalling the distance between the point of the snout and the last tubercle but three on the central ridge of the tail; from the point of the snout to the temporal orifice, is rather more than one-third the length as far as the end of the anal fin, and one-fourth the length as far as the termination of the first dorsal. Body very thin; snout pointed, conical; pectorals large, somewhat of a triangular form, uniting in front at the snout, and terminating at the base of the ventrals; the anterior margin rather concave, the posterior margin rounded; ventrals about three times the length of their breadth; anals commencing close behind the ventrals, and terminating in a free point; rounded at the outer margins. Tail short and firm; along its mesial line is a row of tubercles with sharp points directed downwards, about eighteen in number; no lateral spines visible. First dorsal fin small and rounded; second dorsal rather smaller than the first, of the same form; caudal fin rudimentary. Colour of the upper surface of the body of a dark olive-green, with numerous white spots; on the under surface dark grey, with minute specks of a deeper colour. Skin, both above and below perfectly smooth; a strong, sharp, bent spine in front of each orbit; no spine or tubercles of any description on the back. Mouth large, placed beneath; teeth small, not so large or so sharp as those in *Raia batis*."

THE SKATE.

BLUE SKATE *and* GREY SKATE, *Scotland.*—TINKER, *Lyme Regis.*

Raia batis, MONTAGU, Wern. Soc. ii. p. 423.
,, ,, *The Skate*, PENN. Brit. Zool. iii. p. 111.
,, ,, ,, JENYNS, Man. Brit. Vert. p. 510, sp. 199.
,, ,, *Slät rocka*, NILSS. Ichth. Skand.

THIS species, which is frequently called the True Skate, to distinguish it from the Thornback and Homelyn, which are also popularly called Skate, is not so commonly taken as either, but excels both as an article of food.

It appears to be found among the Orkneys, in the Forth, and on the coast of Scotland, where it is called Blue Skate and Grey Skate. From thence southward as far as Kent, and again westward to Cornwall, it is found along the whole line of coast. In Ireland, the Skate is taken from Cork up the east coast to Antrim, and from thence northward and westward to Londonderry and Donegal. At Lyme Regis, on account of its dusky-grey colour, it is called the Tinker.

The *Raia batis* of Dr. Fleming, p. 171, is referred to by Müller and Henle as a fictitious species, made up of one of Willughby's (61) and another of Pennant's, vol. iii. p. 82, first edition. The *Raia batis* of Linnæus (Gmel.) and of Lacépède are placed by Müller and Henle among the undetermined Skates.

In this species both sexes when adult have sharp teeth, the points beginning to elongate by the time the body of the fish has attained the breadth of twelve or fourteen inches. The females are generally called Maids; and fishermen distinguish the females of the three species of most frequent occurrence by the names of Skate Maid, Thornback Maid, and Homelyn Maid,—frequently calling the old male of the Skate with his two long appendages the Three-tailed Skate. In each of these species the females are observed to be much more numerous as well as larger than the males. Pennant mentions having seen a Skate that weighed two hundred pounds. It is very voracious, and Mr. Couch has known five different species of fish, besides crustaceans, taken from the stomach of a single individual. There is reason to believe that the true Skate produces its young later in the season than either the Thornback or the Homelyn.

The breadth of the body is to its length nearly as four to three; the form of the nose conical: the lines from

the nose to the extreme lateral angle of each pectoral fin slightly concave; from thence to the ventral fins, the posterior free margins are rather convex; the eyes are slightly elevated above the mesial dorsal line, with a short, hard tubercle in the front of each, and a second on each inner side; the irides are yellow, and close behind them are the valvular temporal orifices: the dorsal ridge of the body is without spines till near the origin of the ventral fins; then commences a single row on the mesial line, reaching along the tail as far as the first of the two small dorsal fins, all the points of the spines being directed backwards; a single spine stands between the two fins. On the sides of the tail of a female of small size, there were no lateral spines; but in a young male of the same size there were several lateral spines on each side, the points of which were directed forwards, and in that respect they are characteristic of this species. The colour of the upper surface of the body and tail is greyish-brown: the margins anterior to the angles of the pectoral fins are tinged with reddish-brown; and the edges behind the angles are brownish-black, darker than the body: on the under surface the colour is sooty white, with dark lines in various directions, and numerous mucous pores looking like blue specks with small sharp points disposed among them. The nostrils are valvular, half the width of the mouth in advance of each of its angles; the mouth is rather wide.

I may here add that the true Skate, the subject of the present article, the Long-nosed Skate, the Sharp-nosed Skate, and the Flapper Skate, which precede it, are, in some localities, included under the general term of Skate, from their similarity in colour. The word Skate is derived in Dictionaries from the Anglo-Saxon *Sceadda;* and it may be that the gliding motion of the fish sug-

gested the appellation of the contrivance for travelling on ice, in the Dutch *Schaats*, and also that of Skid for the shoe which is placed under a carriage-wheel when descending a steep declivity.

Dr. Ball mentions in a note to Thompson's Natural History of Ireland, that there is a Skate measuring seven feet in length, in the Dublin University. When it was opened, its stomach was found to contain a large Fluke.

Hark! 'tis the weary Fisher's Evening hymn,
The day is ended and the toil is o'er;
The ropes are coil'd, the sails are furl'd and trim,
The nets are dry, the boat is on the shore.

F. Tennyson.

THE BORDERED RAY.

Raia marginata, Lacepede. Shaw, G. Zool. pl. 139.
,, ,, *Bordered Ray*, Flem. Brit. An. p. 172, sp. 27.
,, ,, ,, ,, Jenyns, Man. Brit. Vert. p. 512.
,, ,, Müller und Henle, Plagiost. p. 140.

The Bordered Ray, as it is called from the broad dark marginal edge of its pectoral fins, has been taken at Liverpool, Brighton, and Weymouth; it has also been obtained at Dieppe, and was noticed by MM. Nöel and Lacépède. It is a well-known species in the Mediterranean, described by M. de Blainville, the Prince of Musignano, and M. Risso. But little is known of its habits, and it does not attain a large size. M. Risso states that the flesh is considered to be pretty good.

The following description of a specimen obtained at Weymouth by Professor Henslow is copied by permission from Mr. Jenyns.

"Total length fifteen inches six lines: length of the head from the end of the snout to the spiracles behind the eyes, three inches six lines; of the tail from the vent to its extremity, seven inches nine lines: greatest breadth across the pectorals, eleven inches three lines. (The total length of M. de Blainville's specimen was two feet.) The form rhomboidal; the transverse diameter rather more than one-third greater than the length from the end of the snout to the vent: snout elongated, projecting considerably from between the pectorals, terminating in a sharp point, with the lateral margins nearly parallel for the last quarter of their length: mouth moderately wide; jaws transverse; teeth numerous, closely set, in several rows, roundish or somewhat quadrilateral at the base, each terminating in a sharp point: nostrils in a line with the corners of the mouth, and rather more than half-way between them and the upper margins of the pectorals; a channel from the nostrils to the mouth, covered by a membranous flap: eyes and spiracles both large: skin perfectly smooth above; and beneath also, excepting along the anterior margins of the pectorals and the surface of the snout, which are set with very minute spines and denticles: one large spine above each eye, inclining backwards, and another smaller one behind each eye: no spines on any part of the back, but three rows on the tail, one occupying the middle ridge, the two others the sides; the spines on these rows strong and sharp, and mostly inclining backwards: tail scarcely longer than the body, depressed, rather stout, with two moderately-sized finlets of equal form, nearly contiguous; scarcely the rudiment of a caudal: pectorals

broad, with the anterior margins hollowed out, and not prolonged beyond the basal half of the snout; ventrals moderate, deeply notched or bilobated. General colour of the upper part reddish-brown, somewhat paler on the pectorals, with a faint indication of round whitish spots; beneath white, with a broad border all round, especially beneath the angles of the pectorals, of dark reddish-brown, approaching to dusky; tail entirely black."

After the preceding portion of this article was printed, for the second edition of British Fishes, Lord Cole kindly sent a specimen of the Bordered Ray from Lyme Regis.

God be with thee, gladsome Ocean!
How gladly greet I thee once more!
Ships and waves, and ceaseless motion,
And men rejoicing on thy shore.

COLERIDGE.

THE SMALL-EYED RAY, OR PAINTED RAY.

Raia microcellata, Small-Eyed Ray, Montagu, Wern. Mem. vol. ii. p. 430.
" " " " Flem. Brit. An. p. 171, sp. 23.
" " " " Jenyns, Man. Brit. Vert. p. 515, sp. 204.

Colonel Montagu and Mr. Couch appear to be the only British naturalists who have obtained this species; and it must be considered a rare one, since the first of these gentlemen saw but two examples, and the latter has only seen one. The very small size of the eye is stated by both to be a remarkable and striking distinction.

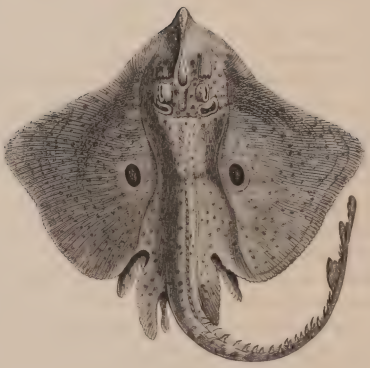
The length of the specimen obtained by Mr. Couch was thirty-three inches and a half, of which the tail measured

thirteen inches; the breadth across the fins twenty-four inches; the eyes three inches apart, and five inches and a half from the snout. The outline of the body much resembles that of the Thornback, *R. clavata;* snout a little prominent, the margin waved to the extremity of the expansion, which is rounded behind; the eyes are very small; the temporal orifices large: the body is covered with rough granulations, but is altogether without spines, either on its disk or about the eyes, except a row that runs along two-thirds of the back, and down the middle of the tail to the fins; an irregular row of similar hooked spines extends along each side of the tail; the tail is bordered, on each side, by a membranous seam; two rounded fins are situated towards the end of the tail, the hindmost being one inch from the end, with which it is continuous by means of an elevated ridge. In the distribution of its colours this is the most beautiful of the British Rays. The upper surface is a light grey, with a lighter line running along the back and middle of the tail, enclosing the central row of spines. The disk is beautifully and regularly quartered, first by three white lines enclosing each other, and passing in a curve from near the eye to near the extremity of the expansion, the convexity of the arch inwards, and consequently the shorter line nearer the margin; on the hinder edge of the disk, formed by the pectorals, are two other curved lines passing from behind the expansion to the neighbourhood of the abdominal fins, the convexity of the arch facing inwards; on the more central part of the disk there are a few whitish spots, those of both sides answering to each other; the extreme edge of the disk posterior to its greatest expansion, and also the abdominals, as well as the fin-like margin of the tail, are edged with white. The nostrils have a prominent expanded membrane;

width of the mouth three inches; teeth flat, like those of the Thornback; mucous orifices on the under surface numerous, and as if punctured with a pin; the colour of the skin a pure white.

Such is the description Mr. Couch gives of his specimen, which was a female, and was taken by a line on the 28th of January, 1835. In it numerous eggs were found, some of which had attained their full growth;—a circumstance which fixes the period for the production of the young in this species. Mr. Couch has since obtained a second specimen, and Mr. M'Coy has described an Irish one in the sixth volume of the Annals of Natural History.

Montagu says both his examples were females, resembling his *R. maculata* in form; Mr. Couch refers to the Thornback for shape: the figure here given is taken from Mr. Couch's drawing, and it will be observed that all three have considerable similarity of outline. A few extracts from Montagu's description will exhibit further resemblance. The proportions by measurement are very nearly alike; the upper surface pale brown, with a few scattered spots and lines of a lighter colour on the margins of the wings; the skin covered with minute spines, which make it feel rough: the remarkably small eyes, at once point out a material distinction, those of the *R. maculata* being of nearly double size: one row of small hooked spines on the tail, continues along the dorsal ridge to the head; the under parts are smooth and white; the teeth obtusely cuneiform, with a broad edge that feels rough to the finger.



THE HOMELYN RAY.

THE HOME, SAND RAY, AND SPOTTED RAY.

Raia miraletus,	Linnæus.	Müller und Henle, p. 141.
,, *maculata,*	*Sand Ray,*	Montagu, Wern. Mem. ii. p. 426.
,, *miraletus,*	*Mirror Ray,*	Donov. Brit. Fish. pl. 103.
,, *rubus,*	*Rough Ray,*	,, ,, ,, pl. 20.
,, *oculata,*	*Mirror Ray,*	Flem. Brit. An. p. 172, sp. 26.
,, *maculata,*	*Spotted Ray,*	Jenyns, Man. Brit. Vert. p. 514.
,, ,,	*Homelyn,*	Thompson, Nat. Hist. of Irel. iii. p. 260.

This smooth-skinned spotted Ray, called *Raia lævis* and Homelyn so long ago as the time of Merrett,* and one of our most common species along the line of our southern coast has not been so well distinguished or so clearly defined by some authors as its obvious characters admit and require. The males, though they have, like

* Pinax Rerum Naturalium Britannicarum. London, 1667, p. 185.

the females, a perfectly smooth skin, have also spines about the eyes, rows of small hooks on the upper surface of the pectoral fins, one row of spines along the dorsal ridge, one on each side a little below the commencement of the dorsal series, and when full-grown, three rows of strong spines on the tail. Thus extensively armed, the male has been called *rubus*:* but those authors who quote as a synonyme the *R. rubus* of Bloch, part iii. pl. 84, have been misled by the German ichthyologist, whose figure proves his fish to have been a male of the Thornback, of which his plate 83 is the female.

The Homelyn of our coast has been best made out and described by Mr. Donovan, Colonel Montagu, and more recently by the Rev. Mr. Jenyns, under the different names here quoted. Mr. Thompson enters into considerable detail respecting its distinctive characters.

This species is liable to some occasional variation in the manner in which the upper surface of the body is spotted; the spots are sometimes numerous, at others sparingly distributed: it is often quite free from spots, and occurs also with only one eye-like spot on each side, not far removed from the line of the back. Independent of the accessory organs, the skin is quite smooth. These variations have given rise to the different trivial names *miraletus*, *oculata*, *lævis*, and *maculata*, which have been applied to it by different authors, from the appearance of the particular specimens examined.

Colonel Montagu, referring to the *miraletus* and *rubus* of Mr. Donovan, had no doubt that they were both identical with his own *maculata*, since, being a common species on the Devonshire coast, Donovan had ample op-

* Müller and Henle enumerate the Rough Ray of Pennant (Brit. Zool. 85, No. 32, 1st Edit.), or the *Raia rubus* of Shaw and Fleming among their doubtful species. Among which they also place the *Raia rubus* of Risso and *La raie ronce* of Lacépède.

portunities of seeing it under its different appearances; and has given correct figures both of the Mirror Ray and of the Homelyn, as quoted, the latter under the trivial term *rubus;* but he believed, with Montagu, that they were not distinct species. He had noticed two similar eye-like spots on several small examples of the true Skate (*batis*); and I possess young specimens of the Thornback (*clavata*) with the same sort of ocellated lateral spots, and have seen many others of the three most common species similarly marked. Mr. Donovan's remark accords so closely with my own view, that I insert it here in his own words :—

"Although we present this as the *Raia miraletus* of Linnæus with perfect confidence, it is not without some hesitation at least that we can offer it as a distinct species. In every respect, except the ocellar spot on the wings, it perfectly agrees with the Homerling Ray, and may possibly prove, on further examination of other specimens, to be only a *lusus*, or remarkable variety of that fish."

The Homelyn and the Thornback, which are not very dissimilar in shape, though otherwise perfectly distinct, are the two species most common in the London market: a large proportion of both are taken in the trawl-nets on the Hampshire and Sussex coasts.

This species is not common on the east coast of Scotland. In Ireland it has been taken all round the coast, and on the northern and eastern parts Mr. Thompson says that it and the Thornback are the most common Skates.

The form is rhomboidal; the diameter of the body about one-fourth greater than the length: the nose short and blunt, its projection beyond the outline of the pectorals but small: in a young male specimen of twelve inches in breadth the secondary sexual characters begin to appear; there are numerous small spines about the

nose, and some extending along part of the anterior edge of the pectoral fins; two or three prominent spines before and behind each eye, with rough granulations on the surface of the skin before and between them: other characters of the males have been already noticed. The eyes and temporal orifices are large: the central row of dorsal spines commences above the middle of the body, and there is one strong spine on each side of it about the middle of the body, or in the line of its greatest diameter: the series of spines on the dorsal ridge extend along the centre of the tail, and a row runs along each side of it in adult specimens; in young examples the series on each side is not complete. On the tail are two small fins, with two spines between; the points of all the spines on the central line and on the tail are directed backwards.

The colour of the upper surface is a pale yellowish or reddish brown, with spots of darker brown, subject to the variations that have been already pointed out; the colour of the under surface plain white; the skin smooth; nostrils and mouth near the end of the nose; the mouth transverse, rather small. Montagu says, both sexes of the *maculata* have sharp teeth; but this refers to examples that are perfectly adult: young males of small size, and females when larger, have the teeth blunt; in old males, and very probably also in old females, from the operation of those laws which influence the secondary sexual characters, the teeth become pointed.

The term Sand Ray is in some localities applied to the males of this Skate, but that name belongs to the next species.

THE SANDY RAY.

THE CUCKOO RAY.

Raia radula, Delaroche, in An. du Mus. t. xiii. p. 321.
,, ,, Müller und Henle, Plagiost. 133.
,, *Sandy Ray*, Thompson, Nat. Hist. of Irel. p. 263.

Subsequent to the publication of the Supplement to the first edition of the British Fishes, containing an account of the Sandy Ray, Captain Portlock, of the Ordnance Survey, sent excellent drawings of a male and female of this species, which were caught in the North of Ireland, and from the drawing of the female the

representation at the head of this subject was engraved. I am moreover indebted to Captain Portlock for many other interesting communications on the Natural History of Ireland. The Sandy Ray has also been taken in Dublin Bay. The detailed description by Mr. M'Coy of a Ray without a name, in his paper on some rare fish from the coast of Ireland, printed in the sixth volume of the Annals of Natural History, p. 405, appears to belong to this species. In April 1858, a specimen of the Sandy Ray caught at Broadhaven in the north of Scotland, was brought to that earnest cultivator of Natural History, C. W. Peach, Esq., and subsequently, in the same season, that gentleman ascertained that five or six other examples had been taken on the coasts of Banffshire. The species has been found in the Mediterranean, among both the Balearic and the Greek Islands, and probably therefore inhabits all parts of that sea.

The disk is broader than it is long, in the proportion of four to three, and its greatest width is about equal to the distance between the vent and acute tip of the snout. Anteriorly the sides of the disk are straight, or undulated by a wide shallow incurvature next the lateral corner: that corner and the posterior one of the pectoral fin are broadly rounded off. Two lines running backwards from the point of the snout form an isosceles triangle, having the distance between the nostrils as a base. The adnate upper eyelid has a boldly-convex edge between two notches. Teeth flat in the females and young males. The distance between the two pectorals does not equal the length of the bases of these fins.

Back wholly set with prickles inclined backwards, more sparingly between the keel of the snout and the inner borders of the pectorals. There are a few stouter prickles round the inner borders of the eyes and before

and behind these organs; and more or less numerous small spines arm the ridge of the back. On the back of the tail, and sometimes between the dorsal fins, there are larger prickles, standing close to each other, and not in a regular mesial row, but often in pairs, or alternately, and frequently spreading over the side. The lateral ridge of the tail, over the cuticular keel, bears either small recurved prickles, or larger stelliform ones, resembling those of the ridge of the back. Ventral surface smooth, and only in some instances is there a roughness on the under surface of the tail.

Colour yellowish-brown, sometimes reddish-brown, with dark lines, partially parallel to the sides of the disk, and here and there anastomosing, also many scattered black and brownish-black spots. On the scapular arch on either side, there is a black ocellated spot placed in a dark patch, and sometimes there is a small second ocular spot behind each. Ventral aspect white, with dark borders. Sometimes on the under surface of the tail there are a few dark, brownish patches or crossbars.—*Müller und Henle.*

This species is the *Raia radula* of Cuvier, Risso, and Bonaparte, and the *Raia virgata* figured by Geoffroy in his great work on Egypt (pl. xxvi. fig. 2, 3). It is also most probably the *Raia circularis* of Jonathan Couch (Mag. Nat. Hist., xi. p. 71). A coloured drawing of the Circular Ray made by Richard Quiller Couch, Esq., corresponds exactly in the outline of the disk, the form of the fins, and the relative length of the tail, with the Sandy Ray. It has also the six white spots with dark borders of the latter, the only difference in the figure being the want of the large spot on each limb of the scapular arch, which, according to Müller and Henle, is sometimes absent.

THE SHAGREEN RAY.

WHITEHAUSE, *Scarborough.*

Raia fullonica, Ascanius, t. xliii. Müller und Henle, 145.*
,, *chagrinea*, *Shagreen Ray*, Montagu, Wern. Mem. ii. p. 420, pl. 21.
,, ,, ,, ,, Penn. Brit. Zool. iii. p. 117 (87, No. 34, 1st Edit.).
,, *aspera nostras*, Ray, Syn. p. 26, No. 5.
,, ,, *Shagreen Ray*, Flem. Brit. An. p. 172.
,, *chagrinea*, ,, ,, Jenyns, Brit. Vert. p. 513.
,, ,, ,, ,, Parnell, Wern. Mem. vii. p. 431, pl. 41.

* The *Raia fullonica* of Linnæus (Gmelin, 1507), of Olaus Olavius (Isl. 53), of Rondelet (356), of Mohr, and of Nilsson's Prodromus (119), are all enumerated among the indeterminate synonyma of Müller and Henle. The *Raia fullonica* of Risso is referred by these ichthyologists to the *Raia asterias* (350) and *R. oxyrhinchus* (347) of Rondelet.

In the first edition of the History of British Fishes, I made the mistake, from the want of specimens, of confounding the Shagreen Ray of Montagu with the Long-nosed Skate of Mr. Couch. Dr. Parnell very kindly set me right, and sent to me, from Edinburgh, an example of the Shagreen Ray, which appears to be a rare species here in the south; at least, I have not as yet been fortunate enough to obtain one.

According to the late M. Fries of Stockholm, the Shagreen Ray of English authors, so called from the rough shark-like texture of the skin, is the *Raia fullonica* of Linnæus, and is probably, though this is considered doubtful by Müller and Henle, the *fullonica* of Rondelet, p. 356 of the Latin edition of 1554, and p. 283 of the French edition, printed at Lyons in 1558. This species is also probably the *R. fullonica* of the Danish naturalist, M. Müller.

In the Frith of Forth, according to Dr. Parnell, "The Shagreen Ray is occasionally taken in the stake-nets set in deep water, more especially in the months of May and June, when a few may be seen in the Edinburgh market along with Grey Skates and Thornbacks. It is known to the fishermen under the name of Rough Flapper, and its flesh is considered inferior as food to that of the other species of Skates, being soft and dry. It feeds on small Starfish, and crustaceous animals in general."

Pennant met with a specimen at Scarborough, where he says that it is called the French Ray, and is caught on hooks baited with Sand-Eels or Sand-Launce. It is also named Whitehause (*i. e.* throat) there.

Montagu has noticed it on the Devonshire coast, and mentions having seen several of both sexes, but none larger than that which he has described. He adds, that

it is known to some of the west country fishermen by the name of Dun Cow.

The Shagreen Ray has been taken on the north-east coast of Ireland, by the collectors employed on the Ordnance Survey; and Mr. Thompson has included the species in his Report to the British Association on the Vertebrata of Ireland, which is published in the volume for the year 1840.

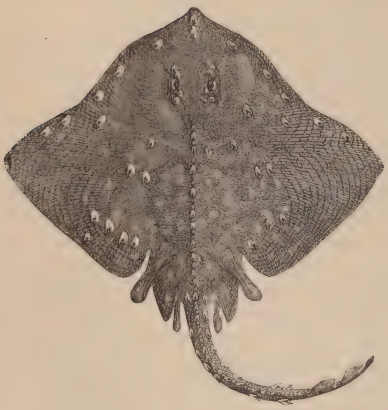
Dr. Parnell's specific characters, and description, from the fish, while fresh, which I hope, on that account, to be excused for making use of, are as follows:—

"Body on the upper surface very rough; on the under surface of a pure white; a row of spines round the inner edge of each orbit; two rows of large bent spines on the tail."

"A female specimen, three feet two inches in length, tail included. Body of a rhomboidal form; the transverse diameter rather greater than the distance between the tip of the snout and the end of the anal rays; from the point of the snout to the tip of the pectoral, and from thence to the base of the ventral fin on the opposite side equal; the length of the tail equal to the distance from its base to the posterior margin of the orbit; from the tip of the snout to the middle of the eye, one-seventh of the whole length, caudal included; the transverse cartilage is situated mid-way between the extremity of the nose and the termination of the base of the anal fin. Snout sharply conic; the anterior margins of the pectorals slightly sinuous; the posterior margins rounded; ventrals narrow, being three or four times longer than their breadth, placed between the termination of the large broad pectorals and the commencement of the anals, composed of five rays, of which the second is the longest. Anals rounded at their outer margins, and terminating

free below, about five times the breadth of the ventrals, each furnished with about twenty-one rays. Dorsals approximate, small and thin, situated nearly at the extremity of the tail, both of equal size, rounded at their posterior free margins; each fin furnished with eight rays, which appear to branch off from one large ray situated horizontally. Caudal fin rudimentary, about half the length of the base of the second dorsal. Colour of the upper surface of the body of a uniform yellowish-brown; under surface pure white. Eyes large; a temporal orifice situated at the posterior part, and a little on the outer side of each orbit; mouth large, placed beneath; teeth strong and sharp-pointed, arranged in each jaw in many rows. Skin on the upper surface very rough, having a granulated feel when the hand is passed over the pectorals; at the base of the ventral and anal fins the skin is perfectly smooth. About six large bent spines, with broad bases situated on the upper part of the snout; round the inner margin of each orbit there are from ten to twelve of these spines, arranged in the form of a crescent; on the dorsal ridge, from the nape to the transverse cartilage, is a row of six spines; about a little more than half-way down the back commence two rows of spines, which run down the tail as far as the first dorsal fin; the first ten or twelve spines are very small, the rest gradually increase in size as they proceed; each spine has its broad base more or less grooved, and its point directed backwards; on each side of the base of the tail are a number of small hooked spines, placed in two or three irregular rows; no spines on the central ridge of the tail."—*Parnell.*

Montagu's figure, in the Memoirs of the Wernerian Society, was taken from an old male; the figure here given is that of a female, carefully reduced from Dr. Parnell's fish.



THE THORNBACK.

MORCATH BIGOG, *Wales.*—KNAGG-ROCKA, *Scandinavia.*

Raia clavata, BELON. 80. RONDELET, 353. BLOCH, 83.
,, ,, *Thornback*, WILLUGHBY, p. 74.
,, *rubus*, *Rough Ray*, BLOCH, pl. 84, old male.
,, *clavata*, *Thornback*, PENN. Brit. Zool. iii. p. 122, pl. 14, female.
,, ,, ,, DONOV. Brit. Fish. pl. 26, female.
,, ,, ,, FLEM. Brit. An. p. 170.
,, ,, ,, JENYNS, Man. Brit. Vert. p. 516.
,, ,, ,, THOMPSON, Nat. Hist. of Irel. iii. p. 262.
,, ,, FRIES, Arter af Raia, t. ii. f. 1.
,, ,, *et rubus*, BLAINV. Faun. Franc. 33 and 21.
,, ,, *Knagg-rocka*, FRIES och EKSTRÖM, Skandin. Fisk. pl. 35.

THE THORNBACK exhibits very marked distinguishing characters, and being also a very common fish, is one of the best known of the species of Rays,—a term which Mr. Couch considers to be derived from the Anglo-Saxon "Reoh," meaning "rough," and is particularly

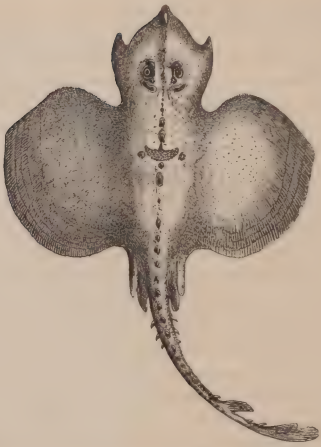
appropriate to the Thornback, which, on the Cornish coast, is pre-eminently distinguished as the Ray. The Thornback is also taken commonly both on the coast of Scotland and Ireland. From the good quality of the flesh of this fish, and the immense quantity taken every year, the Thornback, and its female, the Maid, is one of the most valuable of the species. Mr. Couch says that the flesh takes salt well, and in this preserved state affords the poor fishermen and their families many wholesome meals when stormy weather prevents them obtaining fresh supplies. The Thornback is captured in the greatest abundance during spring and summer, because the fish then frequent sandy bottoms in shallower water and come nearer the shore than usual, for the purpose of depositing their eggs; but the flesh of the Thornback at this season is not, as before noticed, so firm as in autumn and winter. It is in the best condition for table about November. Their food is various other fish, particularly Flatfish, testaceous mollusks, and crustaceans.

Bloch's figure, plate 83, represents the female of this species, under the name of *R. clavata;* and the fish next in succession in that work, plate 84, is an old male of the same species, but is called *R. rubus*, although most of the synonymes quoted are those of *clavata*.*

The figure here given was taken from a young male measuring fourteen inches in breadth. The point of the nose is but little produced: the anterior margins of the pectorals are undulated; the outline behind each lateral angle of the pectorals is nearly straight, or slightly rounded: the eyes and temporal orifices are rather large, with two or three strong hooked spines both before and

* The description of *Raia clavata* of Montagu (Wern. Mem. ii. p. 413) is, according to Müller and Henle, a compound of *R. clavata* and *radiata*. The *Raia clavata* of Brunnich, of Linnæus (Gmel. 1510), and of Müller's Prodromus, p. 37, are doubtful species, according to the authors of the *Berschreibung der Plagiostomen*.

behind them. The whole upper surface of the body is rough with small points, which when examined with a lens have stellated bases. Besides these, there are distributed over this upper surface numerous nail-like tubercular spines, each of which has an oval osseous base; the margin of the base is entire, with a central projecting crooked shank or spine directed backward. Two of these broadly-based spines occupy the central ridge of the nose; others, to the number of thirteen or fourteen, are distributed over each side with some regularity, and are similarly disposed on the two sides. The dorsal ridge of unequally-sized spines begins a short distance between and behind the temporal orifices, one or two small spines occurring between each of the larger ones: this single line of spines extends to the origin of the tail, where three rows of spines begin and are continued along it, forming a series of powerful weapons. The tail is furnished with two membranous fins on the upper central ridge, and ends with a small dilatation. The prevailing colour of the upper parts is brown, with numerous lighter-coloured spots, and sometimes, as has been noticed already, with one larger rounded spot on each pectoral. Young males and females have fewer spines on the body than old males, and both sexes attain some size before they put forth any; they have frequently also but one row of spines along the tail. The colour of the under side is pure white, with a few spines only on each side. The teeth of the adult male in this species are decidedly different from those of the female, as shown in the woodcut at the bottom of page 497; those on the left hand being from a male fish, and those on the right from a female fish of the same size, and representing one-half of the inside of the mouth of each as seen from behind.



A MONSTROUS THORNBACK MAID.

Among Mr. Yarrell's papers there is a sketch of a Thornback, having the proximal angles of the pectoral fins separated from the sides of the head, and standing forwards like horns nearly as far as the snout. A note respecting it from Dr. Parnell says that the specimen was eighteen inches long, and the pectorals, he believed, had been severed by a knife when the fish was young, and had healed in the form they had when the fish was recaptured. Dr. Fleming, to whom the specimen belonged, acquiesced in this opinion.

In the winter of 1838, J. R. Wallace, Esq., of Distington, bought a Skate in the fish-market of Douglas, in the Isle of Man, which is represented by the above

wood-cut, executed from a sketch of the original by Professor Rymer Jones. It has more the appearance of a congenital monstrosity than of a deformity artificially produced by cutting the living animal; and we may remark that similar abnormal developments of other species occasionally occur, such as the Flying-shoulder Ray of the Canton fishermen, of which there is a well-drawn figure in the series of Chinese drawings of fishes presented to the British Museum by John Reeves, Esq. It is, in fact, a *Pteroplatea micrura* with the pectorals divided in the middle, so that the fish appears to have two pairs of these fins.

Mr. Wallace's specimen has all the characters of a female Thornback, as far as the mode of its preservation allows them to be made out. The exact forms of the spout-holes of the nasal lobes and of the corner-folds of the lips have been unavoidably defaced by drying, but in other respects the fish has been carefully preserved, and its external figure skilfully retained. Just as in the ordinary female Thornback of the same age, there is a series of strong compressed thorns on the ridge of the back and tail, the foremost one standing a short way in front of the dorsal disk of the scapulo-coracoid arch. This disk, which shows through the dry integument, measures an inch and a half transversely and half an inch longitudinally; and at each of its lateral extremities there is a small thorn. There is also a thorn between the two dorsal fins, and a conspicuous one over the tip of the snout. Likewise a lateral series of strong thorns at the base of the tail on each side, and many small slender ones more posteriorly. Moreover, the eyebrow is terminated before and behind by a stout conical thorn with a compressed tip. All the thorns are curved towards the tail.

The minute scales which give roughness to the whole dorsal aspect of the fish, including the eyelids, pectoral fins, posterior lobes of the ventrals, and the tail, are nearly uniform in size, and are equally crowded, except over a small space behind the spout-holes, whereon they are smaller and more numerous. Under a lens each scale is seen to be hisped, with divergent sharp points and a terminal cusp inclined backwards. They arrest the finger when drawn towards the head. The ventral aspect is quite smooth, except that there is a patch of minute scales at the fore part of the rounded pectoral disk, and some scattered ones along the outer sides of the gill-openings and outer curve of the body. The teeth are smooth, without cusps.

The specimen measures twenty-one inches to the point of the tail, and has an extreme breadth of fourteen inches, from tip to tip of the pectoral rays. Mr. Wallace describes the colours as having been an uniform yellowish-brown, without any darker markings.

BILLINGSGATE.

Quid ais venefica ?

There, stript, fair Rhetoric languish'd on the ground ;
His blunted arms by Sophistry are borne,
And shameless Billingsgate her robes adorn.

THE DUNCIAD, iv. 24.

THE STARRY RAY.

Raia radiata, *Starry Ray*, Donov. Brit. Fish. pl. 114, female.
" " " " Flem. Brit. An. p. 170, sp. 20.
" " " " Jenyns, Man. Brit. Vert. p. 517, sp. 206.
" " Fries, Arter af Raia, t. iii. f. 4.
" " *Klo-rocka*, Fries och Ekström, Skandin. Fisk. pl. 43.

This very beautiful and well-marked species was made known by Mr. Donovan in his History of British Fishes, and a very good coloured representation of it is added in that work, which will prevent its being confounded with any other.

Mr. Donovan's specimen, which was not more than four inches across and seven inches in length, was caught

on the north coast of Britain, and was communicated to him by Mr. Stuchbury.

Dr. Fleming, in his History of British Animals, quotes as a synonym to *radiata* the *R. fullonica* of the Fauna of Greenland, by Fabricius, and his opinion is backed by Müller and Henle, who add that it is the *Raia eglantiera* of Lesueur. It is a Northern species, and the only three examples of it I have seen were received, one from Berwick Bay, and two from the Frith of Forth. The first was a female, for which I am indebted to the kindness of Dr. George Johnston, and from this example the figure here given was derived. In 1835, Dr. Parnell sent to me from Edinburgh two examples, a male and a female, which had been obtained in the Forth, and obligingly permitted me to retain the male for my own collection, which came marked accordingly. On comparing these three examples with Mr. Donovan's figure, no doubt remained that they were of the same species. It is enumerated by the Rev. George Gordon as one of the Skates that frequent the Moray Frith; and in the *Skandinaviens Fiskar* it is stated that the Starry Ray or *Klorocka* inhabits the northern seas only, extending from the British Isles to Iceland and Greenland, the coast of Norway, and the Baltic as far as Scania. The young, apparently newly excluded, are taken in the winter.

The habits of this fish are but little known, and the figure here given being that of a female, I shall closely describe the male, which was nineteen inches long from the point of the nose to the end of the tail, and fourteen inches in breadth; the snout but little produced, almost falling in with the line of the anterior margin; the lateral expansion of the pectorals and their posterior margins are rounded; the pelvic fins are rather large: the central ridge of the nose, and a great portion of the

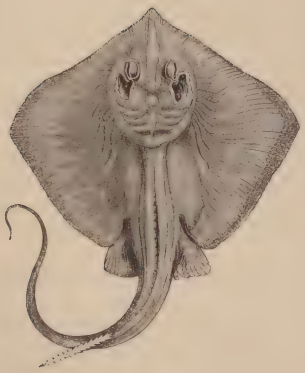
pectoral fins or wings, are covered with asperities of different sizes, the forms of which are all alike, being a single spine bent backwards, arising from a stellated base of many radii; these appear to be nearly symmetrical in position and number on the two sides: the eyes are blue and rather large, placed about half-way between the central transverse cartilaginous arch of the body and the end of the snout; before each eye there is one large spine, and two behind, with several smaller ones along the inner edge of each orbit; temporal orifices rather large; one large spine before the transverse scapular cartilaginous arch, one on the centre of it in the line of the dorsal ridge, and two at each of its lateral extremities: below this cross-bar commences a series of equally large spines on the dorsal ridge, which extends to the first fin on the tail; among these large spines there are a few smaller ones, and on each side of the central row of large spines there is another row of spines about half the size of the large ones, but more numerous, forming together three distinct rows down the back and tail; all of them, though differing in size, have the same character in respect to the beautifully-radiated form of the base from which the ascending spine arises: the upper surface of the body independently of this arming is perfectly smooth; and the colour is pale brown, with a tinge of orange-brown.

On the under surface the colour is uniformly white; the skin soft and smooth; the nostrils large, defended by a cutaneous valve; the mouth rather small; the teeth in the male have the internal angle elongated and sharp, and in a second specimen, a female of ten inches only in length, the teeth are becoming pointed.

The sexual appendages in the male here described are half as long as the tail; and as these, as well as the

other sexual distinctions, are well marked in this fish, which only measures fourteen inches in breadth, I am induced to believe, from the early acquisition of these characters, that this species does not attain a very large size. This species is probably the *Raia asteria aspera Rondeletii* of Willughby, p. 73, pl. D, 5, f. 4, and the *Raia aspera* of M. de Blainville, in the *Faun. Franç.;* but I have not included these names among the synonymes at the head of the subject, for the want of that additional certainty which good figures would have supplied.

ERITH CHURCH.



THE STING RAY.

FIRE FLAIRE, OR FIERY FLAW.—MORCATH LEFYN, *Wales.*

Trygon pastinaca,	*La Pastinaque,*	Belon. 94. Cuvier, Règne An. ii. p. 399.
Pastinaca marina,	*Rondeletii,*	Willughby, p. 67, C. 3.
Trygon pastinaca,	*Common Trygon,*	Flem. Brit. An. p. 170.
Raia ,,		Linnæus. Bloch, pl. 82.
,, ,,	*Sting Ray,*	Penn. Brit. Zool. vol. iii. p. 125.
,, ,,	,, ,,	Donov. Brit. Fish. pl. 99.
,, ,,	,, ,,	Jenyns, Man. Brit. Vert. p. 518.
,, ,,	,, ,,	Parnell, Trans. Roy. Soc. Edin. 1839, p. 145.

Trygonidæ. *Family Characters.*—Point of the disk formed by the union of the tips of the pectorals. Upper eyelid adnate. The two inner nasal lappets coalesce, and have a common, free, and shortly-fringed under border, which is attached to the upper jaw by a slender mesial bridle. The inner angles of the nostrils closely approach each other under the nasal flap: there is no outer nasal lappet. The skull is higher than in the Skates. The spout-

holes are large, and close behind the eyes. Teeth transversely elliptical, with a rounded cross ridge, and a root either acute or divided into points. Ventrals simple. Tail thin, often pointed, and resembling the thong of a whip, without lateral cutaneous keels: it is either naked or bears one or more barbed spines, and it has no kind of fin either at the end or before the spine. Skin smooth, or beset with tubercles and prickles. The prickles, which usually appear on the pectorals of the male Skates, are not developed in the Trygons.

Trygon. *Generic Characters.*—Tail armed with one or more spines, either wholly without the semblance of a fin or with only a vertical cutaneous hem without rays. Disk oval or rhomboidal; tail as long or longer than the body. Mouth slightly arched. The teeth have a cusp, or a rounded transverse mesial ridge, with sometimes parallel furrows before and behind it, which are more distinct in the lateral teeth. The entire dorsal aspect of the body is more or less wrinkled. The interior velum of the upper jaw has a straight, long-fringed margin, and behind it there is a second, deeply-notched plait. Usually there are a few papillæ behind the under teeth.

The Sting Ray was well known to the ancients, who entertained many curious notions of the power and venom of its spine; and it was noticed as an inhabitant of the seas of this country so long ago as the days of Merrett and Sibbald. Dr. Parnell obtained one in the Forth, but it is more frequently taken on the southern coast than elsewhere, from Sussex even as far west as the county of Cork in Ireland, and it is mentioned in Thompson's Natural History of Ireland, on the authority of Mr. Good, that in 1846–7 a number of Sting Rays were taken at one haul of a trawl-net on the Waterford coast. It appears, however, otherwise, to occupy an extensive range, being found in the Mediterranean, and from thence to a high degree of north latitude on the coast of Norway.

Colonel Montagu, in his Notes, mentions obtaining a specimen, taken at Hastings, which was presented to him by the Rev. Mr. Whitear. "At the base of the bony process in the tail of this fish, was a smaller one ready to replace the original if by accident it should be lost; or possibly this weapon may be deciduous and occa-

sionally discharged." Two were obtained in the London market in 1840.

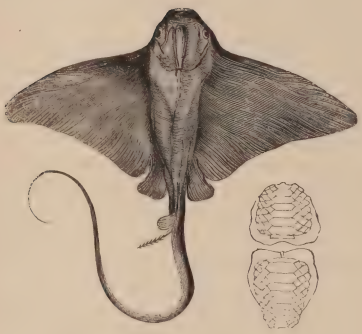
Mr. Couch in his MS. says, "This species keeps on sandy ground at no great distance from land, and in summer wanders into shallow water, where it is often entangled in the fishermen's nets, in which way it is usually caught, for it rarely swallows a bait. The manner in which this fish defends itself, shows its consciousness of the formidable weapon it carries on its tail. When seized or terrified, its habit is to twist its long, slender, and flexible tail round the object of attack, and with the serrated spine tear the surface, lacerating it in a manner calculated to produce violent inflammation." Other authors state that it is capable of striking its weapon with the swiftness of an arrow into its prey or enemy, when with its winding tail it makes the capture secure. These spines, as may be supposed, possess no really venomous quality, but when lacerated wounds happen to men of a bad habit of body, the symptoms are frequently very severe. In some countries, serrated fish spines, admitting of easy application by tying, are used to point arrows and spears, which when thus mounted become very formidable weapons.

A specimen examined and described by Pennant was two feet nine inches long from the tip of the nose to the end of the tail; to the origin of the tail, one foot three inches: the breadth, one foot eight inches. The body is quite smooth, except, according to M. de Blainville, a few small tubercles along the central line of the back and tail, as well as on the upper and posterior part of the pectoral fins—probably a male fish; the shape is almost round, and of a much greater thickness and more elevated form in the middle than any other of the Rays, but grows very thin towards the edges; the nose is very

sharp-pointed, but short; the irides are of a gold-colour; behind each eye the temporal orifice is very large: the colour of the upper surface of the body is a dirty yellow; the middle part being an obscure blue: Mr. Donovan says the young are spotted with brown. The tail and spine are dusky; the former very thick at the beginning: the spine, placed at about one-third of the length of the tail from the body, is about five inches long, flat on the top and bottom, very hard, sharp-pointed, the two side edges thin, and closely and sharply serrated the whole way; the tail extends four inches beyond the end of this spine, and becomes very slender at the extremity. Underneath the fish is white; its nasal lobes are very large, and the mouth and teeth small.

The flesh is said to be rank and disagreeable, and when laid bare by skinning, or cutting into, is very red,—a circumstance which may account for the old name of Fire Flaire.

STOP THIEF!



THE EAGLE RAY.

THE WHIP RAY, THE MILLER.

Myliobatis aquila,	Risso.	Müller und Henle, 176.
Aquila Bellonii,	Salviani, 147.	Copied by Willugh. C. 2.
Raia aquila,	*Whip Ray,*	Penn. Brit. Zool. vol. iii. p. 128.
,, ,,	,, ,,	Jenyns, Man. Brit. Vert. p. 519.

Myliobatidæ. *Family Characters.*—Pectoral fin-rays not continued forwards on the sides of the head, which is more elevated above the plane of the disk than in any other family of Rays, and projects out of the profile of the disk as far as the gills: but before the skull the pectorals again develope rays, and constitute a kind of cephalic fin at the tip of the disk. Nasal lappets of each side coalescent into a quadrilateral fringed flap, which reaches to the mouth. Nostrils closely approximated to the mesial plane, and separated merely by a thin bridle, which is slightly pointed in the middle and is connected laterally with the corner of the mouth on each side. Mouth transverse. Dental plates reaching far backwards into the mouth; teeth broad and flat, resembling a mosaic pavement. The upper velum, springing from the palate and chops, is very long, convex on the edge, and fringed in the middle: the under velum is close to the teeth, and behind there are only a few papillæ. Eyes and spout-holes separated by a broad bridge, and situated on the sides of the skull. No eyelids. Tail long, whip-like, with a dorsal fin on its root, and a spine behind it.

Myliobatis. *Generic Characters.*—End of the pointed snout formed by the union of the foremost anteecephalic rays of the pectorals. Border of the conjoined nasal lappets straight. Mouth transverse. Both jaws straight on the edge. Teeth hexangular, the middle row composed of long transverse plates, flanked by smaller flat rhomboids, fitting into the spaces between the corners of the middle ones. Dental plates on the upper jaw forming a convex surface both transversely and longitudinally: on the mandible the dental surface is flat or slightly concave: neither of them cover the whole width of the jaw.

Pennant, in his British Zoology, states that Mr. Travis, surgeon at Scarborough, had the tail of a Ray brought to him by a fisherman of that town, who had taken the fish in the sea off that coast, but threw away the body. It was above three feet long, entirely covered with hard obtuse tubercles, extremely slender and taper, and destitute of a fin at the end. The tail of a fish received from Sicily, and believed to have been cut from a specimen of the Eagle Ray, which is not uncommon in some parts of the Mediterranean, corresponded with the description given by Mr. Travis.

On this authority the Eagle Ray was admitted into the first edition of the History of British Fishes, in the hope that observers on the coast would be induced to record any new occurrence that might come under their notice. Aware of this, says Dr. George Johnston, in the Proceedings of the Berwickshire Naturalists' Club, for September 1839, "it was with no ordinary delight that I received a perfect specimen of the *Raia aquila* on Wednesday last, September 11th, which had been found that morning on the shore of our bay (Berwick) near Spittal. It was quite fresh, and in fine preservation; and proves, as I think, that the conjecture of Mr. Travis's fish being the *aquila* is perfectly correct. There is, at all events, now no doubt that this species is a native of our seas."

Mr. R. Quiller Couch observes in the Zoologist

(1977), that he trawled up the head of a species of *Myliobatis* off Limorna, Cornwall; and in August 1845, Mr. Peach sent to Mr. Jonathan Couch an egg-purse got near Fowey, that contained an embryo, which Mr. Couch had no difficulty in deciding to be a *Myliobatis*. —*Zoologist*, 1982.

The following is Dr. Johnston's description of his specimen:—"Body rhomboidal, laterally expanded and flat; thickish, and raised in the middle, which gradually passes into the thin sides or fins: of a uniform dusky olive-green colour, smooth and even. Head depressed, with a square vertex, or we may compare it to the figure of a horse's hoof, having an oblong space in the centre that represents the hollow part of the hoof; the front suddenly lowered, round and entire. Eyes lateral, wide apart, roundish, dark grey, overhung by a bony ridge. Behind them there is a large elliptical hole, leading to the gills. There is a series of punctures on each side of the head, becoming most distinct and visible on the occiput. Each fin forms a wide triangle, with entire plain margins. Posterior fins (ventrals) square, and very small proportionably. Tail once and a half as long as the body, flagelliform, tapering to a point, quadrangular, smooth, furnished with a small fin within two inches of its root, and immediately under this fin the spine, or sting, is protruded, which is upwards of three inches in length, linear-lanceolate, long, serrated on both sides, the serratures reflected. Ventral surface whitish, duskier at the sides, smooth. Teeth transverse, linear-oblong, with a small open space between the end of every pair on each side."

"Extreme breadth twenty-one inches. From the snout to the insertion of the tail thirteen inches. Length of the tail twenty-one inches and a half."

I should be most ungrateful if I did not here record my sincere thanks to Dr. Johnston, whose extreme liberality induced him to present this interesting and unique British specimen to me, and it is now preserved in my collection, containing most of our British Rays.

This fish is called Eagle Ray from the wing-like form of the pectoral fins; and Whip Ray, from the long, slender, and flexible character of its tail. The outline near the figure of the fish represents the teeth of the upper and under jaw; each jaw forms part of a circle; and from a particular rolling motion, added to the crushing power of these teeth, the fish has acquired the additional name of the Miller, in this and in some other countries.

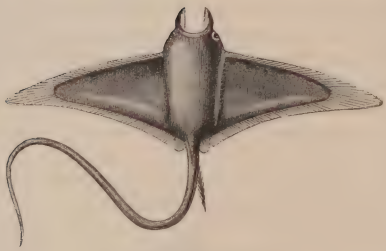
The Eagle Ray inhabits the Mediterranean and the Atlantic from the German Ocean to the Cape of Good Hope. Risso says that it is taken throughout the year at Nice, and is exposed for sale in the markets of Sardinia and Rome. The wounds produced by the caudal spines are so dangerous, that the fishermen cut them off immediately on raising the fish out of the water, and in Sardinia this practice is enforced by a local ordinance. Spallanzani and others have satisfied themselves that the serrated spines produce painful penetrating lacerated wounds, dangerous as such, but without a trace of poison. Risso says that the Eagle Ray swims rapidly without much action of the pectoral fins, that its flesh is not much esteemed, but that the oil obtained from the liver is used in paralytic affections.

I find this species, the one last described, the Sting Ray, a Torpedo, and four other species of Rays, included in a catalogue of one hundred and thirty-seven different kinds of fish, of Malta and Gozo, with their Maltese, Latin, Italian, English, and French names, as

well as their season, drawn up by Gaetano Trapani, first clerk in the Office of the Magistrate for the markets, printed at the Government Press, Malta, 1838. For a copy of this very useful little book I am indebted to the kindness of Mrs. Sarah Austin, a sister of Richard Taylor, Esq.

THE FLYING-FISH.

. . . . sidus fugiens ubi Piscis aquosi.—Georg. iv.
Sublimi feriam sidera vertice.—Hor. Od. i. 36.



THE HORNED RAY.

Cephaloptera Giorna, Risso, Hist. Nat. t. 10.
,, ,, Thompson, Report Brit. Assoc. 1840, pp. 399 and 409.
,, ,, Idem, Nat. Hist. of Irel. iii. p. 263.

Cephalopteræ. *Family Characters.*—Front of the head transversely straight, with the precephalic fin proceeding from the root of the pectoral on each side and projecting like an ear, curling upwards and inwards. Mouth in front or underneath, reaching nearly to these ears. Under border of the coalescent nasal flap straight: nostrils near the cephalic fins widely apart. Eyes on the sides of the skull immediately before the commencements of the pectorals. Spout-holes on the dorsal aspect divided from the eyes by a wide intermediate space. Tail as long or longer than the body, supporting a dorsal fin, and behind it a spine.

Cephaloptera. *Generic Characters.*—Mouth on the ventral surface. Teeth of both jaws small, flat, pavement-like, of divers forms. The rays of the pectoral extend forwards close upon the skull, and the front border of that fin is convex from the skull, behind the eyes out to its lateral apex.

To William Thompson, Esq., of Belfast, one of the Vice-Presidents of the Natural History Society of that town, we are indebted for many valuable and interesting notices of the fishes of the Irish lakes and coast which are distributed in various parts of this work. In 1835 this excellent naturalist made the following communica-

tion to the Zoological Society of London, which is published in the Proceedings for that year, at page 78:—

"*Cephaloptera*, Dumeril. — A fish of this singular genus, taken about five years ago on the southern coast of Ireland, and thence sent to the Royal Society of Dublin, is at present preserved in their museum. In breadth it is about forty-five inches. The specimen being imperfect, and the characters of some of the species being ill-defined, I hesitate applying to it a specific name. It somewhat resembles the *Cephaloptera giorna* as figured by M. Risso."

In the Natural History of Ireland Mr. Thompson adds, "Before publishing a notice of the *Cephaloptera* in 1835, I referred to *Raia Fabroniana* of Lacépède, and considered that the specimen had about as much resemblance to it as to *Giorna*, and Müller and Henle, the highest authority extant, have brought the two names together as representing but one species. The specimen was so imperfect, and so much distorted by the preserver, that though in possession of an accurate drawing of it, I was unwilling to have it engraved."—*Thompson.*

Horned Rays, differing greatly in size, appear to have come often under the observation of M. Risso at Nice;* and the following remarks in reference to the Natural History of the species, are derived from his published works.

This fish approaches the shore, and is most frequently taken in the month of July. From their horned aspect small ones are called *vacchetta*,—young cow; the larger ones *vacca*. When found in pairs, the males appear to have a strong attachment to the females. M. Risso relates that a female was taken in one of the divisions or

* Large individuals, named by Risso *C. Massena*, are considered by Müller and Henle to belong to this species.

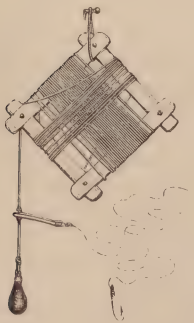
chambers of a net arranged to catch Tunnies: the male constantly remained in the vicinity for two days, from time to time approching and wandering round the net, as if in search of the female. Two days afterwards he was found dead in the same division of the net which had proved the fatal prison of his companion. The young come forth in September, having been previously deposited by the mother in long yellowish eggs. The food of the species consists principally of cephalopods and fishes. The liver is large, and produces abundance of oil; and in the stomach and intestines there are numerous internal folds. Contrary to what has been usually observed of the tenacity of life in cartilaginous fishes, the Horned Ray dies immediately on being taken out of the water, and even when tied to a rope and allowed to remain in the sea, it does not survive its captivity beyond a few hours. Its flesh is red, dense and hard, difficult of digestion, and in no esteem, but yet it is eaten by the poorer classes in Italy. The females are larger and darker than the males. The species attains an almost incredible size. M. Risso saw a male that weighed eight hundred pounds, and a female that weighed twelve hundred. Le Vaillant saw three in latitude $10\frac{1}{4}^{\circ}$ N., longitude 335° W., and the crew having captured the smallest, he ascertained its breadth to be twenty-eight feet, its length twenty-one, and estimated the weight at one ton. The mouth was wide enough to admit a man. Lacépède named the species in compliment to Professor Giorna of the Academy of Turin.

The following description is translated from Müller and Henle.

Teeth extending to the corners of the mouth, only about a third of a line broad in the upper jaw, in the middle roundish, on the sides broader than long,

nearly hexangular, on the mandible roundish, somewhat more projecting, but not pointed. Pectoral fin much broader than long, convex in front, concave behind, with acute outer and hinder corners. Ventrals rounded. Tail longer than the body in the proportion of three to two, according to Risso. Dorsal fin triangular. Back smooth, but on the hinder half covered with a peculiar kind of small scales which appear like fine white streaks, and are rough to the touch, but do not prick. Tail smooth for a quarter of its length, then rendered uneven by little knobs. This is the only European example of the genus yet described.

SEA HAND-LINE.



The following passages relating to fishes are extracted from Beckwith's enlarged edition of Blount's Tenures.

"In the simplicity of older times, when gold and silver were scarce, the household of the king was supported by provisions furnished from his demesnes. By degrees the servants there employed obtained a fixed tenure of the estates, rendering certain services, and supplying certain provisions. Many lands were from time to time granted on condition of yielding such supplies; but these reservations were small, and many of them only to be rendered when the king travelled into the country where the land lay. In some, special care was taken that he should not make this service burthensome by coming too often.

"*Aylesbury.*—William, son of William of Alesbury, holds three yard-lands of our lord the king in Alesbury, in the county of Bucks, by the serjeanty of paying three Eels to our lord the king, when he should come to Alesbury in winter.

"*Conway Castle.*—Is now held of the crown by Owen Holland, Esq., at the annual rent of six shillings and eightpence, and a dish of fish to Lord Hertford as often as he passes through the town.

"*Degenure and Eglosderi, county of Cornwall.*—William Trevelle holds one Cornish acre of land in Degenure and Eglosderi, by the serjeanty of finding one boat and nets for fishing in Hellestone Lake, whensoever our lord the king should come to Hellestone, and so long as he should stay there.

"*Glowcester.*—Pennant states that it has been an old

custom for the city of Gloucester annually to present the sovereign with a Lamprey pie, covered with a large raised crust.

"*Rodeley, county of Gloucester.*—Certain tenants of the manor of Rodeley pay to this day, to the lord thereof, a rent called Pridgavel, in duty and acknowledgement to him for their liberty and privilege of fishing for Lampreys in the river Severn. Pridgavel: Prid, for brevity, being the latter syllable of Lamprid, as this fish was anciently called; and gavel, a rent or tribute.

"*Stafford.*—Ralph de Waymer held of the king in fee and inheritance the stew or fish-pond without the eastern gate of the town of Stafford, in this manner, that when the king should please to fish, he was to have the Pikes and Breams; and the said Ralph and his heirs were to have all the other fishes with the Eels coming to the hooks, rendering therefore to the king half a mark at the feast of St. Michael.

"*Yarmouth.*—The town of Yarmouth in Norfolk is bound to send to the sheriffs of Norwich a hundred Herrings, which are to be baked in twenty-four pies or pasties, and thence delivered to the lord of the manor of East Carlton, who is to convey them to the king. They are still sent to the clerk of the kitchen's office at St. James's. In 1778, the sheriffs of Norwich attended with them in person, and claimed the following allowance in return, viz.—'Six white loaves, six dishes of meat (out of the king's kitchen); one flaggon of wine; one flaggon of beer; one truss of hay; one bushel of oats; one pricket of wax; six tallow candles.' But no precedent appearing of these things having been delivered, they were refused."—*Records of the Board of Green Cloth.*

List of fish served at the feast held on the enthronization of Neville, Archbishop of York, in the 6th year of the reign of Edward the Fourth (A.D. 1466).

First Course.

First Potage.
Almond butter.
Red Herrings.
Luce salt.
Salt Ele.
Kelyng, Podlyng, Haddocke. } Boyled.
Thirlepoole rost.
Pyke in barblyt.
Eeles boyled.
Turbut baked.
Fritters fryed.

Second Course.

Fresh Salmon jowles.
Salt Sturgeon.
Whytyngs.
Pyichers.
Eeles.
Mackerells.
Places fryed.
Barbells.
Conger rost.
Troute.
Lamprey rost.
Bret.
Turbut.
Roches.
Salmon baked.
Lynge in jelly.
Tench in jelly.
Crabbes.

Third Course.

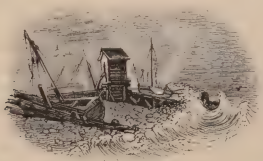
Jowles of fresh Sturgeon.
Great Eels.
Boyled Conger.
Cheuens.
Breames.
Rudes.
Lamproues.
Small Perches fryed.
Smelts rost.
Shrympes.
Small Menews.
Lobster.

This list is remarkable for the variety of fish served at one entertainment. Of the Carp family, Breams, Barbels, Rudds, Roaches, Chubs, Chevens (*Chevennes*), Minnows and Tench are mentioned, but not the Carp itself, which fact may be advanced in favour of the opinion that it is comparatively of recent introduction into our stews. Kelyng is an old name for the Cod-fish,

and Podlyng for the Cole-fish. As the orthography of the list is not uniform, Pyichers may perhaps mean Pilchards (*Peltzer* of Schonevelde). Pyke and Luce are different designations of the same fish; but we have not ascertained what fish is called Thirlepoole. Thirle, from the Anglo-Saxon *thirlean*, to bore, is synonymous with drill; and pole may here be equivalent to the Dutch *pijl*, or the Danish *pil*, the head of a javelin (*pilum*). If such be the composition of the word it might denote the Greater Weever, or Etterpyle (vol. i., p. 1); or should pole have its more common meaning of a stake or pile (*pol* or *pal*, Anglo-Saxon, *paal*, Dutch) the fish in question may be merely one of the boring mollusks. Another conjectural explanation offers. The Thirlepoole may have been Whale's flesh. In the *Speculum Mundi*, the Spermaceti Whale is called the "Whirlpool Whale." Barblyt is explained in Jamieson's Dictionary by "barbed."

To this churchman's feast the following Welsh receipt for preparing "fish potage" may be appended.

"Take a salmon, salmon-trout or flounder, and boil it in water with some parsley, French leeks, some flour and butter; put some new milk thereto, and healthy nourishment it is."—*Translated from the Welsh MS. of old Jolo Morganwg, by the Rev. Joseph Hughes of Meltham.*



APPENDIX.

Fishes constitute the lowest Class of the Vertebral Branch of the Animal Kingdom. In common with the other members of that Branch they have a *continuous longitudinal nervous axis*, composed of four parallel columns, one pair of which are recipients of the *nerves of sensation* coming from the surfaces of the body, and the other pair are the roots of the *nerves of volition* or of action issuing peripherad to the muscular envelopes. The nervous axis is inclosed in a tubular case, which in many fishes is wholly membranous or cartilaginous, but in others is more or less completely bony, and composed of segments named *vertebræ*, because their joints admit of certain turnings or bendings; in various cartilaginous fishes the necessity for joints is superseded by the flexibility and elasticity of the spinal column, which appellation includes in these cases both the spinal marrow and its envelope.

Except in the lowest (fœtal?) form (*Amphioxus=Branchiostoma*) all fishes have an enlargement of the proximal or anterior end of the nervous axis, called the *Brain*, with which the nerves of smell, sight, taste, and hearing, are connected. Professor Owen has subdivided the Mammals according to the complexity of the structure of the brain, but as yet this organ has not been used as the basis of an arrangement of fishes.

Parallel to the tubular envelope of the nervous axis, and between it and the surface of the belly (or *ventrad* of it), the vertebrals are provided with a more capacious tube, divided into chambers by perforated diaphragms, and containing the organs of respiration, circulation, digestion, excretion, and also, when it exists, the hydrostatic organ, or swim-bladder. This type of structure is common to all vertebrals, but the peculiar attribute of Fishes is, that in them the function

of respiration or the oxygenation of the blood is performed through the medium of water by *gills*, not merely temporarily during the fœtal condition or infancy of the animal, as in the Amphibians or Tadpoles, but during the continuance of life.

The general form of a fish is familiar to all, and is easily recognised, but the divergences from the usual shape are very great, and no limited formula of words can be made to comprehend the figures of the long, slender, finless Ophisure; the spherical Globe-fish; the cubical, box-like Ostracion; the compressed Flounder, with its contorted visage and its sides of different hues, so that one of them is erroneously called the belly; the depressed, expanded Skate, with its wide flappers and its whip-like tail; the hideous Pelors or Devil-fish, with its flabby cutaneous appendages; the hammer-headed Zygæna, having its eyes laterally stilted out; the Angler, consisting chiefly of mouth; the Pterois, with its gaily-coloured plume-like dorsal; and a vast variety of other shapes not less strange.

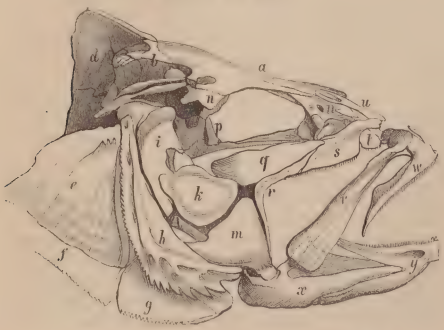
A thorough acquaintance with piscine structure in all its phases is required for the due apprehension of the various *plans* on which Fishes are constructed, but even a condensed treatise on so comprehensive a subject would fill a volume; and this Appendix, therefore, makes no higher pretensions than that of directing attention to the various parts on whose modifications the characters descriptive of species and genera have been hitherto based, and in so doing to explain some, at least, of the many technical phrases that have of necessity been admitted into the preceding pages.

The skeleton, being the framework that sustains the rest of the structure, is naturally the part that is most convenient to begin with. The number of vertebræ composing the spinal column varies greatly, from sixteen, for instance, in the Sunfish, and fewer in the Diodons, to one hundred and sixty-two in the Conger, and two hundred and thirty-six in the foreign Gymnote, or Electric Eel. The shapes of the vertebræ are also various, though more commonly their *centra* or bodies are subcylindrical, or more or less narrowed in the middle of their length, like an hour-glass. The ends by which they come in contact with each other are cup-shaped, and the cups are filled by a bag of gelatine, enclosed in a strong membrane, which being united round the rims of the contiguous vertebral cups, forms a very elastic joint. Some bony pro-

jections, or *zygapophyses*, issuing proximad and distad from each centrum, limit its motions; but the divergent parts of the vertebræ, which more especially require notice, are, in the first place, the *neural spine*, which rises in the mesial plane vertically or dorsad from the centrum, to which it is joined by two legs that have been called *neurapophyses:* and it is within the series of the neurapophysial arches formed into a canal by connecting membrane that the nervous axis or spinal marrow is lodged. A pair of nerves passes off from the neural chord or *myelon* between every pair of vertebræ, each nerve being composed of sensitive and motive filaments. From both sides of the centrum also there springs a *parapophysis*, which in the fore part of the spinal column stands out laterally, and bears one or more ribs for the support and protection of the abdominal viscera. In the Herring family, and in some Scomberoids, the ribs from each side meet on the middle line of the belly in a series of pointed scales, thus completing the inferior arch. Behind the vent the parapophyses bend down, generally without carrying ribs, and uniting a little below the centrum make a narrow inverted arch, and by the series of arches a *hæmal canal*, which protects the longitudinal vascular trunk or aorta. Rising in the mesial plane from above the neural spines, but not united to them, nor always, indeed, agreeing with them in number, are the *interspinals* or *interneural spines*. Similar spines, named *interhæmals*, descend behind the vent from the spinous points of the parapophyses; and the tips of the interneurals and interhæmals reach nearly or quite to the profile of the back and to the under profile of the tail respectively. Peripherad of these interneurals and interhæmals, and, like them, lying in the mesial plane, are the *dermal spines*, enveloped generally in a thin fold of skin, and named, according as they are on a dorsal or ventral aspect, *dermo-neural* or *dermo-hæmal spines*, and in common parlance, *fin-rays*. In the *Acanthopteri*, the anterior rays are for the most part stiff, pungent, and jointless, forming what are named the *spinous rays* of a fin. Some fishes, however, ranked with the *Acanthopteri* because of their general structure, have flexible jointless rays in the fore parts of the dorsal and anal fins, with merely one spinous ray in each ventral, or want the spines altogether. The posterior rays of the vertical fins on

the dorsal and ventral aspect are composed of cylindrical joints, most commonly binate, and often branched, but sometimes simple. The interneural spines at the distal extremity of the spinal column are dilated, of different breadths, and so disposed as to form a fan-like basis for the very constantly articulated dermal rays of the caudal fin, which are most generally branched as well as jointed. Though the spinous and jointed rays of the vertical fins lie all in the mesial plane, in many fishes their true origin in different halves of a binate organism is shown by their sides being alternately broad and narrow on the right and left, as is seen very conspicuously even in the caudal of some Sclerodermes. The general position of the parts of the spinal column and its dermal appendages are shown in the plate of a Flounder's skeleton (i. p. 621); while the arrangement of the interneurals and interhæmals at the caudal extremity of the Short Sun-fish are beautifully represented in vol. ii. p. 434. We shall have occasion to revert to the fins, after having enumerated the bones of the skull. There are no proper cervical vertebræ in fishes, the series consisting of abdominal and caudal vertebræ only, the latter having the parapophyses bent down to form a hæmal arch, and only in a few cases producing ribs.

SKULL OF THE PERCH.



The letters of the preceding wood-cut are quoted in the following enumeration of the bones.

1st. Cranial Ring.—The distal or *occipital* segment of the skull is composed of the *super-occipital* (*d*) which very frequently runs forward between the parietals (*b*), to join the frontal (*a*), and in the Chætodontoids, and other compressed fishes, has a lofty mesial spine or bony crest (ii. p. 169); in the Salmon family (i. p. 231), the parietals meet and interpose between the super-occipital and the frontal, and the super occipital spine projects backwards instead of rising vertically. In the unsymmetrical skull of the Flounder family (i. p. 611) the super-occipital is pushed aside, and one of its lateral plates is not developed. The *par-occipitals* (*c*) are situated one on each side of the super-occipital, being wedged in between it and the ex-occipitals; in the Cod-fish (i. p. 535) an oblique ridge traverses the surface of the par-occipital, and in broad depressed skulls this bone is elevated into a strong longitudinal crest. The occipital arch is completed below by the *basi-occipital*, the most distal part of the base of the skull on the mesial line, and that which furnishes a concave facet, for receiving the capsule of jelly through which the articulation with the proximal end of the spinal column is effected. In the Carps the basi-occipital lodges a bony tubercle, which is covered with a tough plate, and is opposed to the lower pharyngeal teeth (i. p. 396) in the process of mastication. These six bones of the occipital arch, viz. two lateral pairs and a superior and inferior azygos or single bone, close the cavity of the skull posteriorly, and lodge that part of the brain in fishes to which Professor Owen has given the name of *epencephalon;* it unites through the *medulla oblongata* with the spinal marrow or *myelon* at the *foramen magnum*, as the great posterior opening in the arch is called. The acoustic organ is connected with this cranial ring, part of it, on each side, being contained in an interior excavation of the par-occipital and ex-occipital.

2nd. Cranial Ring.—The next segmental arch of the skull or the *parietal*, embraces and protects the part of the brain which is called *mesencephalon*, and is composed in fishes chiefly of the optic lobes. This ring is formed above by the pair of *parietals* (*b*), which in the Pike, Perch, Cod, and many other fishes, are kept apart by the interposition of a process of

the super-occipital. The sides of the arch are formed by the *ali-sphenoids* (*o*) and *mastoids*, and the mesial line below by the *basi-sphenoid* that lies before the basi-occipital, and in the same plane. The basi-sphenoid is connate with the *pre-sphenoid*, a still more anterior part of the base of the skull, and the single bone they form has been named by Owen the *basi-pre-sphenoid*, but as the two ends of the bone form the bases of two cranial arches, it is convenient to speak of them separately.

3rd. Cranial Ring.—The next in succession, or the *frontal* arch, encloses the cerebrum proper of fishes, or the *prosencephalon*. Its upper part, or the key of the arch, is the *mid-frontal* (*a*), which forms the roofs of the orbits, and also enters into the composition of the vault of the cranial cavity. A mesial crest traverses this bone in the Cod, and is continued into the occipital one, and in the genus *Brama* (ii. p. 169) and most Chætodontoids and compressed fishes, the mesial crest of the mid-frontal is very elevated. In fishes which have small deep-set eyes the inter-orbital space is widely expanded. In the Tunny, the frontal crest is composed of a pair of plates, just as the super-occipital is in a few fishes divided into two by a sagittal suture. In most *Acanthopteri* the olfactory groove is framed of short plates descending vertically from the under surface of the mid-frontal. The sides of the third arch are made up of the *orbito-sphenoids* and the *post-frontals* (*n*), while at its base is the *pre-sphenoid*, or the anterior portion of the basi-pre-sphenoid already mentioned. The olfactory nerves pass out of the cranial cavity, between the upper corners of the orbito-sphenoids, and the optic nerves between the lower edges of these bones, or, in some cases, through a special hole.

4th. Cranial Ring.—The nasal arch forms the anterior or proximal end of the skull, and protects the olfactory ganglionic or chord-like prolongation of the brain, termed the *rhinencephalon*. The key-stone of this arch is the *nasal bone* (or ethmoid of Cuvier), which is usually single, and has a blunt proximal end. In the Salmon family (i. p. 231) it is broad but not deep; in the Swordfish (ii. 240) it is long and narrow: it is greatly prolonged in the Trumpet-fish (ii. p. 192); in the disk-bearing Suckers or Discoboles, and in the Lophobranchs it is a short vertical plate; and in the Angler and Globe-fish it is not ossified. In the Flying Gurnard it has no imme-

diate connection with the vomer, which is a rare departure from the common structure. The sides of the nasal arch are formed by the pair of *prefrontals* (*n* *) that defend and support the olfactory ganglions, bound the orbits anteriorly, and afford points of attachment to the palatines and pre-orbital scale-bones, which will be hereafter mentioned. The base of the arch is the *vomer* (*t*), whose distal end is wedged into the under surface of the pre-sphenoid, and whose proximal extremity expands, and is articulated by its lateral angles to the pre-frontals. In many fishes the vomer forms a prominent mesial line in the roof of the mouth, and is dentiferous, and its anterior end, when armed with a cluster or a crescentic patch of teeth, is termed by French ichthyologists the *chevron*, a word which is used in blazoning, has become naturalized in our English descriptions of fishes, and means the angle formed by two rafters. In the Murænoid fishes the parts of the nasal arch coalesce into a single bone, though the disposition of the teeth points to their primary distinction, there being a cluster of teeth on that part immediately under the snout which represents the nasal, and, after an interval further back, longitudinal rows on the vomer. It is proper to notice that Cuvier gives the name of nasal bone to the *turbinals* or osseous capsules of the nose that are situated on the sides or above the true nasal, of Owen, which separates the nostrils more completely in fishes than in the higher forms of vertebrals. In the Carp (i. p. 363) there is a partially-ossified pre-nasal cartilage forming a septum between the turbinals: by this part of structure in its cartilaginous state, the maxillary bones are usually attached to the extremity of the nasal.

The *capsules of the organs of sense* are lodged among the cranial bones. The *olfactory organ* has two capsular bones, the *turbinal* already mentioned, and the *ethmo-turbinal* or *ethmoid*, which is called by French writers *sphénoïde antérieur*. Additional protection to the organ of smell is afforded by the nasal and vomer, which are constituent parts of the proximal arch of the skull. In the Chondropterygian and semi-cartilaginous fishes the proper olfactory capsule is wholly cartilaginous, and the *ethmo-turbinal* continues cartilaginous in many osseous fishes. Even when ossification is established in the ethmoidal cartilage it is usually at its cranial end, where it is perforated for the passage of the olfactory nerves. In the

Perch the ethmoid is a vertical compressed plate, with a forked upper end. In the Gurnards (ii. p. 23) it is articulated to the pre-frontals and nasal. In osseous fishes, in general, each nostril or pituitous cavity has two exterior apertures, differing in that respect from the higher vertebrals which have but one nostril of a side; but some fishes have only one nostril on each side, and one or two genera of Plectognaths are destitute even of a pituitous cavity, the nerve being expended on an imperforate barbel, which cannot be distinguished externally from the barbels that are usually considered to be mere organs of touch. In the *Symbranchidæ* the nasal apertures are situated one at each extremity of a long canal, the lower one often opening within the edge of the upper lip, and thus in some degree impairing the exactness of a character which has been supposed to form a trenchant distinction between fishes and other vertebrals, such character being the want of a posterior nasal orifice communicating with the mouth or gullet. Reference, however, should be made in this case to the function of the nasal sac or canal. In no instance do the nasal orifices of fishes admit air or water of respiration to the gills. In the Chondropterygians the pituitary folds of the organ of smell are mostly pectinated, and are more complicated than in osseous fishes. The differences in the forms of the cutaneous appendages in these fishes are referred to by systematic ichthyologists as affording convenient generic characters. The olfactory nerves of fishes being large, the sense of smell is probably acute, yet many fishes appear to take their prey chiefly or solely by sight.

The *optic capsule* is cartilaginous in the Chrondropterygians, the Lophobranchs, and the Plectognaths; also in the Angler, but in most osseous fishes it is composed of two hollow bony hemispheres. For its lodgment an orbit is formed of the pre-sphenoid, orbito-sphenoid, frontal, post-frontal, pre-frontal, and palatine, and its exterior opening is generally bordered and defined below by the *sub-orbital chain of bones*, which, being considered to be productions of the skin, are named on that account scale-bones, and generally contain many mucipa-rous cavities. The foremost of these bones, lying on the side of the snout, under the nostrils, is often the largest of them, and for distinction's sake receives the name of the *pre-orbital*. The scale-bones have been removed from the skull of the

Perch figured above to allow the subjacent bones to be shown, but they are well seen in the skull of the Carp (i. p. 363), of the Carp-Bream (i. p. 402), of the Umbrina (ii. p. 111), of the Polyprion (ii. p. 128), of the Chrysophrys (ii. p. 134), and in the Sapphirine Gurnard (ii. p. 23), where this chain of bones runs across the cheek and abuts against the hollow of the pre-operculum. In the Vaagmaer (ii. p. 289, and p. 292) the large fibrous pre-orbital is conspicuous on the side of the mouth, and when that is protruded moves forward along with the upper jaw. In some fishes there is a scale-bone above the orbit named the super-orbital, but this is rare. The infra-orbital scale-bones are followed behind the orbit by the *sur-temporals*, which protect a chain of muco-ducts. These ducts continued to the supra-scapular region, there pass into the *lateral line*, that in most osseous fishes runs along the body to the caudal fin, in some even to the extremity of that fin. In a few fishes the lateral line stops short over the vent; in others it breaks off in the tail, and resumes its course lower down, while a few fishes have several lateral lines, such as the Mullets, and especially the foreign *Chiri*.*

The *organ of hearing* in fishes, or the *labyrinth*, has for its special bone the *petrosal*; but the cavity which lodges these parts, or, as it is technically named, the *otocrane*, is formed on each side by the ex-occipital, par-occipital, alisphenoid, mastoid, and post-frontal, and this otocrane has a wide opening into the cranial cavity. The shining, enamelled, meniscoid bones, so easily detected within the skull, and so conspicuous in the Cod, are called *otolites*, and are part of the acoustic apparatus. In the Cod the petrosal is pretty large, but it is small in the Perch, and is still less in the Carp.

The sense of hearing has by some been denied to fishes—perhaps because they exhibit no external sign of ears: the internal structure, however, may be most successfully demonstrated in the various species of Skates or Sharks (ii. p. 476), in which the firmer parts of the head being formed of soft and yielding cartilage, the necessary divisions may be effected with great ease. The Chinese, who breed large quantities of the well-known Goldfish, call them with a whistle to receive their food. Sir Joseph Banks used to collect his fish by

* See page 626 of this volume.

sounding a bell; and Carew, the historian of Cornwall, brought his Grey Mullet together to be fed by making a noise with two sticks.

To complete all that is necessary to say here of the cranium, it may be remarked that on the hinder part of the skull there are generally five salient parts. The mesial one is the tip of the super-occipital spine, which, as has been mentioned in a preceding page, is often continued forwards in a crest between the halves of the frontal, and, posteriorly, it frequently descends over the par-occipitals, to be prolonged on the spinal column by the neural spines. The second crest, named by Cuvier the intermediate one, is on the ex occipital, and, with its fellow on the other side, forms a pair; it is prolonged forwards over the side of the parietal, and sometimes on the frontal. The supra-scapula, which will be again mentioned, is attached to its projecting distal extremity. The third crest, called the external one, forms also a pair with its fellow, and shows itself on the mastoid, from which it runs forwards over the post-frontal, and along the side of the frontal at the edge of the orbit; posteriorly it traverses the petrosal and ex-occipital. The lower limb of the supra-scapula is attached to this crest on the mastoid. The three crests are distinctly represented in the cut of the skull of Ray's Sea-Bream (ii. p. 169), where the supra-scapula, shaped like the letter ≺, is attached to the prominent angles of the intermediate and external crests. In the skull of the Carp (i. p. 363) the super-occipital spine only is visible, the lateral crests being absent. On the presence or absence of these crests the form of the head of fishes greatly depends.

After this enumeration of the bones of the brain-case and the intercalated sense capsules, we have next to notice four parts of the skeleton, named by Professor Owen the inferior or inverted *hæmal arches of the cranium*. 1st. The *palato-maxillary arch* has for its piers the *palatines* (*s*) suspended to the pre-frontals, to the vomer and to the nasal. The situation of the palatines in the roof of the mouth is one on each side of the vomer. In voracious fishes with large mouths the palatines are elongated, while in wide-headed, small-mouthed fishes they are short and broad. At its proximal extremity, the palatine bone articulates with the *maxillary* (*v*), which, with that point as its centre of motion, moves backwards and

forwards on the side of the mouth. In many fishes it forms a considerable part of the border of that orifice, in others it lies wholly behind the premaxillary, whose tip in that case extends to the corner of the mouth. The *premaxillary* (*w*) unites with its fellow on the mesial line, and is more commonly directed transversely than longitudinally. It has a longitudinal process or pedicle, which, in contact or nearly so with the corresponding process of its fellow bone, runs backwards under the integuments of the snout between the nostrils, and in fishes with very protractile mouths, such as the Vaagmaer (ii. p. 292), or the Dory (ii. p. 251), it is of great length, and, as the mouth is retracted or extruded, slides backwards and forwards in its sheath over a groove in the head of the maxillary. The extent into which the maxillary and premaxillary enter into the composition of the upper lip, and their edentulous or dentiferous conditions, form characters for groups of fishes of various importance. The *pterygoid* (*r*) (*transverse* of Cuvier), and the *entopterygoid* (*q*) (*ptérygoïdien interne*, Cuv.), are parts of this arch less constant in their occurrence. The latter lies in the floor of the orbit, and its breadth depends on the depth of that cavity. The *pterygoid* is dovetailed into the distal end of the palatine, and in some fishes appears to form one bone with it. It carries teeth in the Perch as well as the palatine.

2nd. The *tympano-mandibular arch* has its key-stone formed by the limbs of the *mandible* or lower jaw at their junction. Each limb of the mandible is divided into two parts, the proximal or *dentary* part (*y*), carrying the teeth, and the distal or *articular* portion (*x*), whose point slips into a socket of the dentary, and its opposite extremity forms a cavity or trochlea on which the jaw moves. In some fishes the mandible is divided into more pieces, such as the *sur-angular*, *angular*, and *splenial*. The *hypo-tympanic* (*m*) (*jugal*, Cuv.) is a triangular plate, whose proximal head is convex, and fits the trochlea of the articular piece of the mandible. Nearer the base of the skull, and in the Conger and Murry confluent with the hypotympanic, is the *pre-tympanic* (*k*) (*tympanal*, Cuv.), and on its inner side, and reaching nearly to the mandibular trochlea, is the *meso-tympanic* (*l*) (*symplectic*, Cuv.). The arch is suspended by the *epi-tympanic* (*i*) (*temporal*, Cuv.). This bone is very generally forked at both ends in osseous fishes, its upper prongs

being articulated to the post-frontals and mastoid. The lower forks support two separate arches, the anterior prong belonging to the pedicle of the tympano-mandibular arch, which we have just described, and the posterior one to the *hyoidean arch*.

3rd. The *hyoidean arch* is suspended, as has been but now said, through the intervention of the epi-tympanic to the mastoid. The proximal bone in the crown of this inverted arch is the azygos *glosso-hyal*, or tongue-bone, which lies in the bottom of the mouth, between the limbs of the mandible: it is not present in all fishes. The *basi-hyals*, two small subcubical bones, being constant in osseous fishes, are more properly the keys of the arch. At their distal end is the triangular *uro-hyal*. The great horn of the arch meets the mesian chain of the *glosso-*, *basi-*, and *uro-hyals*, at a large angle, descending from the fork of the epi-tympanic in a curve, and is composed of three pieces, the uppermost being the slender *stylo-hyal*, the next the *epi-hyal*, and the third, and by much the largest, being the *cerato-hyal*, to which the *branchiostegals* are attached, and whose lower or proximal end is joined to the pair of small basi-hyals. The use of the branchiostegals is to spread out the membrane of the gill-opening, and to assist in its motions, acting like the elastic ribs of a fan. They vary greatly in number in different genera, being sometimes absent even in bony fishes. They do not exceed three in the Cyprinoids, are seven in number in the Cod, and in the majority of the *Acanthopteri*, and are very long in the Angler, which has an enormous bag-like branchiostegous membrane.

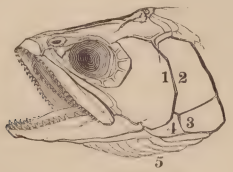
Branchial arches.—These arches belong to what is named in systematic anatomy the "visceral skeleton," but their connection with the hyoid bones makes it convenient to mention them here. In the embryo state of a fish, six branchial arches are usually indicated, but only five are developed, and of these four support gills, the fifth being appropriated to the dentiferous pharyngeal arch. Indeed, normally there are seven arches, but the first becomes atrophied, and vanishes before the last one is developed. These arches spring from under the base of the skull, above the gullet, and, descending in a curve, are connected at their inferior extremities, more or less closely, with the key-bone basihyals of the hyoidean arch, and to a median line of bones running backwards from

the latter, named *basi-branchials*. The arches themselves are composed of chains of small bones united by elastic joints; one of which joints enables the arch to fold up when the mouth is closed, and to bring its upper and under parts into apposition. The portions above and below this folding-joint are usually different in length, the upper part being the shortest. The short pieces which make up the arches are called *hypo-branchials*, *cerato-branchials*, *epi-branchials*, and *pharyngo-branchials*, these pieces being variously distributed among the different arches. The *pharyngo-branchial* is often expanded, and is the *os pharyngien inférieure* of Cuvier. Sometimes the right and left pharyngo-branchials coalesce into one bone, and this circumstance has been employed by Müller to characterize the group which he has named Pharyngognaths. *See* the Saury (i. p. 465), Garfish (i. p. 459), and Flying fish (i. p. 474).

Along the edges of the branchial arches that are turned towards the mouth, there are double or single rows of processes named *rakers*, which are sometimes, as in the Herrings, elongated like a straight-pointed sword, sometimes club-shaped, and in other instances mere sessile knobs. They are, for the most part, armed with fine setaceous teeth, and sometimes with teeth of a more robust kind, and their office seems to be to prevent gross matters from passing out at the branchial openings, and injuring the tender structure of the gills. The water of respiration, entering by the mouth, flows out laterally, bathing and floating out in its passage the soft vascular combs of the gills, and makes its exit by an exterior lateral orifice between the head and the shoulder-bones. In osseous fishes there is but one external gill-opening on each side, which varies greatly in extent in different genera, being in some a small round hole, in others a large crescentic slit, which descends from the supra-scapula to the under surface of the head, and runs forward between the limbs of the mandible to the root of the tongue-bone. In the Sharks and Rays there are generally five gill-openings, and in about two instances, six or seven, as in *Notidanus*. The parasitic Dermopteri, also, have numerous external gill-orifices, and as the suctorial mouth of these parasites is closed to the entrance of water when they are engaged in feeding on the fish to which they adhere, provision is made for the respiratory fluid en-

tering by the gill-openings, or by a special orifice, such as is shown at p. 18 of the first volume.

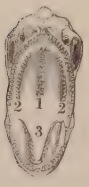
HEAD OF A TROUT.



The *gill-plates* or valves, by which the external orifices of the gills are opened and shut, are intimately connected with the branchiostegous membrane, and also with the tympano-mandibular arch, with whose movements, as well as with those of the flexible branches of the hyoid arches, they act in unison. The relative positions of the four bony pieces of the gill-plate are shown in the accompanying diagram of a Trout's head. The *pre-operculum* 1, (and Skull of Perch, *h*,) bounds the cheek posteriorly, is generally gorget-shaped or crescentic, but sometimes chevroned, its two limbs meeting in an angle more or less acute. At this angle there is often an acute point, or even a strong spine in the *Acanthopteri*, with or without other marginal spines and serratures above and below it. Often, too, a mesial ridge divides the pre-opercular disc into two planes, the anterior of which slopes under the soft parts of the cheek. Very generally the *operculum* 2 (*e*, page 611) is nearly rectangular, as in the Trout; in many Sclerogenoids it is triangular, with a sharply-spinous apex. Situated behind the vertical limb of the pre-operculum, its anterior superior corner is jointed to the epi-tympanic; and its posterior edge, most commonly bordered by membrane, fits closely to the scapula and coracoid when the gill-opening is shut. Beneath it, and sometimes scarcely to be distinguished from it, is the *sub-operculum* 3 (and *f*), underlying its lower edge and angle, and, in most cases, forming, in conjunction with its bordering membrane, the distal apex of the gill-flap: it is less commonly spiniferous than the operculum. A fourth piece, named

the *inter-operculum* 4 (and *g*), is situated before the inter-operculum, and runs forward under the horizontal limb of the pre-operculum towards the articular piece of the mandible. Attached to the lower edge of this bone, and sometimes to its inner surface, is the branchiostegous membrane, with its supporting bones, called *branchiostegals* or gill-rays (5). Above the inter-operculum is connected to epi-hyal or stylo-hyal, and is thus one of the links by which a synchronous movement of the parts concerned in respiration is maintained.

TEETH OF A TROUT.



Having in the course of the preceding enumeration named the direct and inverted arches of the head which bear teeth, a few words may be added here respecting the *dentition* of fishes. In most members of this class the teeth are coalescent with the bony substance of the jaws, through the ossification of part of the formative pulp: in some cases the base, and, much more rarely, the side of the tooth, is united to the jaw, either to the surface, or to the sides of sockets, or imbedded in the substance of the bone, as in Diodon. Equally various are the situations in which teeth are developed. The pre-maxillaries, the maxillaries, the dentary pieces of the mandible, the lips themselves, the vomer in a mesial row, or in a cluster or chevron at its proximal end, the nasal, the palatines, pterygoids, the ento-pterygoids, basi-presphenoid, lingual bone, mesial row of the hyoid bones, and the pharyngeals, with the branchial arches and their rakers, are all dentiferous in one species or another. In the Cyprinoids the teeth are confined to the immediate portals of the gullet, where they form a grinding apparatus in the true Carps, and raptorial or retentive hooks in others of the family. In many cartilaginous fishes, the teeth cover the cartilaginous or semiosseous jaws, in rows, a posterior row coming forwards to supply the place of the front one as that is worn out.

The teeth of fishes vary as much in form as in situation. They are prismatic in the Siluroid *Plotosus*, and confined to the soft lips. In *Myliobates* they have regular geometrical figures; in many Sharks they are lancet-shaped, with smooth or serrated cutting edges, or they have one or more spear-shaped lobes; other no less formidable shapes of squaloid

teeth are represented in the second volume. In bony fishes the most common form of tooth is an elongated cone, often so slender as to be finely *acicular;* if stouter, *subulate;* if they are hair-like, and short and densely crowded, they are said to be *villiform;* if longer and equally slender, *ciliiform;* if stronger and stiffer, *setiform* or *brush-like;* if still coarser and curved, *card-like;* when much shorter than the latter, they become *raduliform* or *rasp-like*. Conical teeth stronger and longer than the others on the jaw are named *canines*, and those with broad flat crowns, such as some Sparoids possess, are termed *molars*, which name is also given to the broad pharyngeal teeth with grooved crowns in the Carps. Some slender teeth have forked tips, others are trifid, and others again are barbed like a fish-hook. Or teeth may be chisel-shaped and incisorial with even edges, or bi-lobed, tri-lobed, five-lobed, or with crenated edges. Kinds of teeth exist in some Mullets or Gobioids and other fishes which none of the preceding terms apply to, and which, therefore, require special descriptions when they are spoken of.

There remain to be mentioned two other important parts of the fish-skeleton, which are considered by Professor Owen to be inverted cranial arches, though their connection with the skull is of a recondite kind. 4th. The *Scapular arch* (*Ceinture osseuse de l'epaule*, Cuv.) is attached to the *par*-occipital, or to that bone and the mastoid, or to the same bone and the petrosal, as in the Cod, or to the par- and basi-occipitals; in the Eels this arch is feebly developed and loosely suspended behind the skull; and in the Plagiostomes it is still farther removed from the cranium. Its superior piece is the *supra-scapula* already mentioned, as being attached by one limb to the intermediate cranial crest, and by the other to the point of the external crest. In the skull of *Platessa* (i. p. 611), it is the upper and most posterior hooked bone. The second piece or *scapula* is well developed in the Perch, but is wanting in the Cod and some other fishes. The third pair of pieces much larger and stronger than the preceding ones, close the arch by their union on the inferior mesial line. They are the *coracoids* of Owen and the *humerals* of Cuvier. The Scapular arch lies behind the gill-opening, imparting form and strength to the shoulder of the fish. By the coracoids defence and support are given to the heart, and attachment to the diaphragm that

separates the pericardial and abdominal cavities. To the scapular arch are attached the pectoral fins which represent the fore-legs or arms of the higher vertebrals. The *radius* (called *troisième os de l'avant bras* by Cuvier) is of enormous size in the Opah and Flying-fishes. The *ulna* (*radial*, Cuv.) is anchylosed to the radius in the Sheat-fish, for the firmer support of the large pectoral spine, and in the Angler both bones are very small, and coalesce with the coracoid. The *carpals*, varying in number from two to five, increase progressively in length the nearer they are to the radial or exterior side. They are broad flat bones in the Wolf-fish. The *meta-carpals* and *phalangeals* are the rays of the pectoral fin, which in the Cod are twenty in number, all of them flexible, jointed, and forked at the end. In the Skates the pectoral rays are still more numerous, and very long. In the Acanthopteri the first ray of the pectoral on the ulnar side is a hard spine without joints. A slender styliform bone, named the *epi-coracoid*, and consisting sometimes of two pieces, is attached to the upper end of the coracoid in many fishes. It is very slender, or altogether absent in the Wolf-fish, Mullet, Blenny, Goby, Stickleback, Sheat-fish, and most apodals. In the Snipe-fish its point is joined below to that of its fellow, thus forming an inverted arch behind the scapular one. It is very remarkable for size in the File-fish (ii. p. 422).

5th. The hinder extremities of the higher vertebrals are represented in fishes by the ventral fins, whose jointed rays are very often five in number, and in the Acanthopteri are mostly preceded by a spine. They are supported by a pair of bones named *pubic*, which are generally both separately and conjointly triangular, the apex of the triangle being turned forwards. In the Cod each plate is forked, and its apex is suspended to the coracoid bone. According as the ventral fins were situated on the belly, under the pectorals or before them, Linnæus termed them *abdominal*, *thoracic*, or *jugular*: and the fish which were wholly destitute of ventrals he named *apodal*. Cuvier included the *thoracic* and *jugular* fishes under the designation of *sub-brachials*, and extended this term to those whose pubic bones were attached to the coracoids, though the fin might be some way behind the pectorals. We have now mentioned the vertical fins which are developed in the mesial plane of a fish, together with the

two lateral pairs, which represent the fore and hind extremities of a terrestrial quadruped. In the embryo osseous fish the vertical fins are first perceptible in form of a continuous fold of integument, extended along the back round the point of the tail, and along the middle line of the belly. The growth of this fold being active at some parts, and checked at others, distinct fins are developed, and supporting rays grow up.

In some fishes the cutaneous mesial folds are persistent without the generation of rays. In the preceding pages the various fins are denoted in the ray formula by their initial letters, and when there are more than one D. or A. fin a line is drawn to denote that there is a depression or space between the numbers of rays mentioned thus —. In the *Acanthopteri* with two dorsals, the first one is usually spinous, and this is indicated by the number of its rays being placed before the horizontal line —, but when the dorsal is single and the fore part spinous, the sign + is placed between the spinous and jointed rays. The short incumbent rays on the base of the caudal are often left out of the reckoning, and when they are enumerated it is in general in shape of a fraction placed after the number of rays having full length, the numerator in this case referring to the upper short rays, and the denominator to the lower ones.

Scales.—These dermal productions are secreted like the teeth in a follicle or cutaneous pouch; and are sometimes wholly covered by soft thick cuticle, as in the Eels, so as to be detected only by close search; but their most common condition is tiled, with the proximal edge retained in the generative follicle, and the distal one extruded and free, the cuticle on the exposed disk being merely like a fine transparent varnish. When examined through a lens these ordinary scales are perceived to be marked with concentric lines, denoting, according to Agassiz, stages of growth by the exercetion of successive layers. Scales with smooth concentric lines are called by that ichthyologist *cycloid*, and those with minute spinous points or teeth on the concentric lines he names *ctenoid*, or pectinated. Usually the ctenoid teeth wear off sooner or later on the disk of the scale, and remain only on the posterior margin, to which the edge of the last deposited layer of growth is supposed to extend. Some of the Gobies exhibit long and beautifully-pectinated marginal teeth.

Examples of cycloid scales are given by several vignettes in the accounts of the Cyprinoids in the first volume, at 406 and other pages following. Ctenoid scales are represented in vol. ii. pp. 103 and 117.*

A third kind of scale is named by Agassiz *ganoid*. It has a hard, shining, enamelled surface, and its subjacent osseous structure contains radiated corpuscles. The Ganoids of Agassiz are the Cœlacanths, Acipenseroids, and Sauroids, to which he adds as doubtful members the Siluroids, Plectognaths, and Lophobranchs. *Placoid* scales, being the fourth kind, want the hard superficial enamel of the ganoid scales, but in some cases at least are constructed of dentine. They exist scattered over the skin of many Rays and Sharks, and on the Plectognaths.

The line of pores denominated *the lateral line*, and generally protected by scales differing in form from the rest, has been already alluded to. Sometimes this line runs only a short way, at other times it is continued to the end of the caudal fin, or it may be interrupted, and resume its course lower down, or there may be several lateral lines, and in the Mullets almost every row of scales shows pores. Besides these pores, which are the orifices of mucous canals, Agassiz has discovered openings in fishes which lead to interior canals that finally end in the circulatory system near the heart. They serve to introduce water into the body, and are supposed by their discoverer to be *safety tubes* for species living habitually at great depths. They may be easily seen in the head of the Common Shad, but are minute in many species, and in freshwater fishes, and marine ones that live in shallow water, they are few. None have been discovered in the Sharks or Rays.

With respect to the skeleton of the Chondropterygians, the student is referred to what is said of the Sharks and Rays

* Dr. Davy has most obligingly furnished the following analyses of two kinds of cycloid scales.

	Coregonus of Ulswater.	Salmon.
Hygrometric water	10·25	25·50
Phosphate of lime with a little carbonate of lime and magnesia and a trifle of mixed saline matters . . .	20·63	17·65
Animal matter dissipated by heat .	69·12	56·85
	100·00	100·00

(ii. pp. 469, 549), and here no more need be added than that in these fishes the parts of the skeleton are not fibrous, as in the osseous fishes, but are always cartilaginous in the interior, though they often acquire considerable superficial hardness by the deposition of earthy matter in the cartilage cells. The cranium is not divided by sutures, but the holes for the transmission of nerves furnish the means of recognising the regions, cavities, and orbits that have been described as existing in the osseous fishes. The hyoid and branchial arches have much resemblance to the same parts in the osseous fishes, but the opercular structure is wanting, and the gills are placed farther back under the commencement of the spinal column. The scapular arch is consequently, in accordance with its function of protecting the heart, thrown farther back also. The supra-scapula, scapula, and coracoids, constituting this arch, are represented by a single piece, which, in the Rays, is attached to the parapophysial processes of the spine, but has no such attachment in the Sharks. The skull of the Porbeagle Shark is represented in vol. ii. p. 499. The pelvic cartilage is also single and transverse, neither joined to the coracoid nor to the spine, but giving out on each side a branch which carries the ventral rays. In the Rays several of the proximal vertebræ of the spine are coalescent, by which the scapular arch receives a firmer support, while the neural rings, and lateral holes for the passage of nerves, enable us to reckon the number of vertebræ that have coalesced.

Viscera.—Only a few particulars of the internal anatomy of fishes usually enter into descriptions of species, and that part of the economy of fishes will therefore be very briefly touched upon in this summary. With respect to the *circulation of the blood*, all known fishes, except the Lancelet, have a distinctly-developed heart for propelling the blood to the gills. In osseous fishes this organ is situated below the last pair of gills, and receives the blood from a large *sinus*, which is the first of the four chambers of a piscine heart, these chambers, it may be observed, lying in a linear series, and giving passage to all the blood of the fish, and transmitting it to the gills. In Reptiles a portion of the blood passes from the heart into the general circulation without going through the lungs. The *sinus* is an enlarged termination of the venous system, and in some fishes only is it included in the peri-

cardial bag. It communicates with the *auricle*, or second chamber in the series, by an opening which is guarded by two valves, that are not, however, to be found in all osseous fishes. A single orifice, also bivalvular, leads from the auricle to the very muscular *ventricle*, or third chamber, and generally to its dorsal part; and the ventricle is surmounted by the arterial stem, which is conical in osseous fishes, but is cylindrical in the Plagiostomes. It is named the *bulbus arteriosus*, and is the fourth chamber. In most fishes there are two valves at the base of the *bulbus*, but the Sun-fish (ii. p. 432) has four valves there, and the Ganoids, Holocephali, and Plagiostomes have two or more circular rows on the inner surface of their cylindrical arterial stem. The arterial stem of *Galeus* has two rows of three valves each, as have also those of *Carcharias*, of *Scyllium*, and of the *Chimæræ*. Three rows of valves exist in the arterial stems of *Sphyrna*, *Mustelus*, *Acanthias*, *Alopias*, *Lamna*, *Rhinobates*, *Torpedo*, and the Sturgeons. There are four rows in those of *Heptanchus*, *Centrophorus*, and *Trygon*, and five in the Common Skate and *Seymnus*, *Squatina*, and *Myliobates*. In the *Cephalopteræ* and in the Ganoid fishes the valves are still more numerous (*Owen*). The reader is referred to vol. i. pp. 23, 34, ii. p. 401, for some accounts of the structure of the gills.

The *air-bladder* or *swim-bladder* is a pneumatic locomotive organ peculiar to fishes, and Professor Owen and many other anatomists consider it to be the homologue of the lungs of terrestrial vertebrals. It extends to a greater or smaller distance along the ventral surface of the spine, and in some groups of fishes communicates by a pneumatic tube, or by a mere orifice, with the œsophagus or stomach; in other fishes it is completely closed; and in many parasitic and ground fishes it is wholly wanting, as is the case in the *Dermopteri*, *Holocephali*, and *Plagiostomi*. It is of various forms, either simple or divided at the ends, or it is separated by transverse contractions, or by longitudinal and incomplete diaphragms into two or more chambers; and in a few instances it is reticulated internally, and then resembles the large-celled lungs of a Reptile. Glandular bodies often exist within the swim-bladder, and are considered to be vaso-ganglions analogous to the thyroid gland, or to pseudo-branchiæ.

Kidneys are developed in all fishes. Professor Owen con-

sidering an elongated glandular body in the Lancelet to be a kidney. In most osseous fishes long narrow kidneys extend under the spine through a great part of the length of the abdomen. Sometimes a single efferent tube or *ureter* springs from the coalescent hinder ends of the pair of kidneys, or more frequently there is an ureter proceeding from each kidney, which in some fishes unites with its fellow to form a common tube before entering the *urinary bladder*, while in others the ureters enter the bladder separately. The urinary bladder is rarely absent in fishes, but there is none in the Pilchard, Herring, and Loach. Dr. Davy detected the presence of urea in the urinary bladders and ureters of such fishes as he examined.

Alimentary canal.—The food is transmitted to the stomach through the pharynx or gullet and œsophagus, being directed in its passage by the rakers on the interior surfaces of the branchial arches, and by them prevented from passing out between the arches towards the gills. The alimentary canal is usually short and simple, and in some fishes runs straight from the mouth to the vent; in others it is larger, and is doubled back once, twice, or oftener on itself. The œsophagus, usually wide and dilatable, sometimes joins the stomach without showing a perceptible line of distinction; in other cases there is a difference in the folds, or a constriction at the upper or cardiac orifice of the stomach. Two notable forms of the stomach occur—the "siphonal," which is a bent tube, with the pyloric opening at its end, as observed in the Flat-fish, Cod, and Salmon; and the "cæcal," in which the stomach ends in a blind bag of greater or smaller extent, the continuation of the intestine going off near the œsophagus. Round the *pylorus*, and often continued along the intestine below it, there are frequently short, slender tubes, closed at the end, named *cæca*. These are sometimes absent, as in the *Dermopteri*, sometimes few in number, sometimes very numerous; and they are clustered and unite into fewer tubes in the Scomberoids, and some groups of fishes allied to them. In the Plagiostomes they assume the form of a conglomerate gland, and show themselves clearly to be modifications of a pancreas. The small intestine, in its course from the stomach to the vent, is sometimes uniform in its calibre and internal coats; but sometimes a part next the vent, which may be named a rectum, shows

internal folds different from the lining of the rest of the canal, and in the Plagiostomes the interior mucous coat of the intestine is lengthened out near the vent, forming in some cases a longitudinal roll, in other cases obliquely-spiral folds. Some *Muraenidæ* shew an approach to the spiral valve in the structure of the posterior part of their large intestine.

The milt of fishes is attached by a doubling of the peritoneum or lining membrane of the belly to the spine between the kidneys. It differs greatly in form in different fishes, but is remarkable in all for its enormous development on the approach of the spawning season. In some fishes, as in the Lampreys, the corpuscular spermatozoons escape by rupture of the covering of the milt into the abdominal cavity, and from thence are expelled by outlets at the vent. In osseous fishes, generally, an efferent tube carries the sperm to an outlet behind the vent, also common to the urethra. In its simplest form the ovarium, or roe-producing organ, is a longitudinal membrane suspended from the spinal column, in which the roe (ova or eggs) are developed, escape, by rupture of their capsules, into the abdomen, and are excluded by the external peritoneal openings, as in the Lampreys and Eels. The same is the case in the Salmon, though in that fish a spermatic duct exists in the male, but in general, where the male has no duct, there is no oviduct in the female. The oviduct of most osseous fishes terminates behind the vent, and generally before the urethra. In a few fishes the eggs are hatched in the ovarian sac, and the young are produced alive. This is the case with some few osseous fishes and with many Plagiostomes, and in these Chondropterygians generally the organization of the reproductive system is of a higher grade.

At the season for depositing the spawn, which varies with almost every genus, some species repair to the gravelly shallows of rivers, and others to the sandy bays of the sea. This movement is called by some fishermen, "going to hill, or roading;" other species resort to bunches of weeds. In many instances, when ready to deposit her spawn, a female is accompanied by two males, one on each side, - a provision of nature which seems intended to secure the impregnation of the largest quantity of ova, and the range of the influence of the male fluid is enormously increased by diffusion in water. The adhesive nature of the surface of each egg supplies the

means of attachment to any of the various substances near which it may happen to be left; and the time required for the appearance of the young fish is very variable, depending upon the species, the season, and its temperature. The young fish is first apparent as a line wound round the central vitelline portion of the egg, and ultimately escapes by rupturing the external capsule with its tail.

Considerable attachment is often exhibited between the parent fish. Mr. Jesse relates that he once caught a female Pike during the spawning season, and nothing could drive the male away from the spot at which the female disappeared, whom he had followed to the very edge of the water. In some species this attachment is not confined to the season of spawning. A person who had kept two small fishes together in a glass vessel, gave one of them away; the other refused to eat, and showed evident symptoms of unhappiness till his companion was restored to him. Some show also an attachment to their young, and watch and defend their own spawn. Pennant says of the River Bullhead, "It deposits its spawn in a hole it forms in the gravel, and quits it with great reluctance." An excellent observer remarks on the same fish:—"It evinces a sort of parental affection for its ova, as a bird for its nest, returning quickly to the spot, and being unwilling to quit it when disturbed." It is believed also of the Lump Sucker, that the male fish keeps watch over the deposited ova, and guards it from every foe with the utmost courage. If driven from the spot by man, he does not go far, but is continually looking back, and in a short time returns. The interesting accounts of the nidification of the Sticklebacks given at pages 77, 85, and 95 of vol. ii., furnish other instances of strong parental instinct in fishes, and many more might be collected from histories of foreign species.

A few observations on the impregnated roe may be worthy attention. Dr. Walker of Edinburgh, in an essay on the Natural History of the Salmon, published in the Transactions of the Highland Society, quoting the experiments of Jacobs of Berlin, says, he found that when the spawn of both sexes were extracted from dead fishes, the ova by mixture with the milt are fecundated; and when placed under water in a proper situation are brought forth into life. He further discovered that this artificial fecundation can be accomplished

with the roe and milt of fishes which have been dead two and even three days. This points out a mode of transferring species from one stream to another within the compass of two or three days' journey. The experiments of Dr. Davy, however, have shown that in the case of the Salmon family the impregnated ova are with more certainty transmitted alive to even much greater distances, and that the more nearly the ovum is to being hatched the better does it bear the journey. If wrapped in moist moss or wool or wet paper, the impregnated ovum may be kept alive for many days, and in water duly changed might be carried to the antipodes, provided the temperature be regulated within the tropics by the use of ice. The young Salmon does not long survive in a heat exceeding 80° Fahr. This subject is so fully treated in the accounts of the Common Trout (i. p. 268) and of the Salmon (i. pp. 172, 215, &c.), that it is not necessary to reprint here more than a few paragraphs of the Instructions for breeding of Salmon by Sir Francis Mackenzie, which were given at length in the Introduction to the Second Edition of British Fishes.

There can be no doubt, from the success which has attended the experiments, that the breeding of Salmon, or other fish, in large quantities, is, comparatively speaking, easy, and that millions may be produced, protected from every danger, and turned out into their natural element at the proper age, that is about two years of age, when the Parr marks disappear; they then assume the silvery scales of their parents, and show distinctly a strong desire to escape from confinement, and proceed downwards towards the sea.

Professor Agassiz asserts, and Sir Francis fully believes, that the ova of all fish, if properly impregnated, can be conveyed in water of a *proper temperature* even across the Atlantic, as safely as if it were naturally deposited by the parent fish, so that any quantity of Salmon, or other spawn, can, after impregnation on the banks of a river, be carried to other streams, however distant, which may be favourable for hatching.

It can only be ascertained by experience what kind or quantity of food will be required for the fry. Carrion hung at the top of the pool would, in the opinion of Professor Agassiz and Mr. Shaw, supply them with maggots; but in this there are difficulties, and when tried by Sir Francis a few

of the fry were found dead round the carrion given to them. The droppings of cattle, allowed to rest till half dry, and occupied by worms and the ova of insects, appear to suit them best.

Sir Francis, when on an agricultural tour of Belgium, visited an establishment belonging to King Leopold, adjoining his new palace of Ardennes, on an expensive scale, where the breeding of Trout had been tried for the three previous seasons, though with but little success. "A very few small Trout," he says, "bred 1839–40, were still alive, but the ova of 1841 were a complete failure, chiefly from not properly covering the spawn with gravel, and other errors. Bread made of brown and white flour mixed was the food found best suited to the few that remained alive, who, judging from their shape as seen swimming about in a small pool, were in excellent condition." The Trout-breeding establishment of Ardennes, however, proves that Trout spawn, if treated in the same way as that of Salmon above described, will produce the same successful results, and that any one possessing a convenient pond or stream may stock it with the best kind of Trout or other fish in one or two years, and by good feeding have them in high condition. Where the Trout already exist, of small size and inferior quality, Sir Francis would advise wholly destroying the breed by saturating the water with quick lime, or any other mode more advisable, and procuring spawn or fry from lakes where the best kinds of Trout are found, in Scotland or elsewhere. The same may be said of Grayling, Pike, or any other kinds of fish suited to ponds, brooks, or rivers, as may be desired by their owners; which renders the discovery now made known of value to all and in all quarters, as well as to salmon-fishing proprietors.

The following extract from the Times gives a report of the British fisheries for 1857. The catch of Herrings was short, and the total cured, amounting to 580,814 barrels, was less than in former years. In the Cod and Ling department, the returns show that 104,668 cwt. were cured dry, and 4313 cwt. in pickle. The quantity of Cod and Ling caught, but not cured, was 53,038 cwt. The number of boats employed was 12,377, of fishermen, 43,011, and the total number of persons engaged in fishing, curing, &c., was 93,596. The

square yards of netting amounted to 89,754,492, and the yards of fishing lines to 35,194,797. The Dutch Government has taken measures to procure an accurate knowledge of the natural history of the Herring, and has published a pamphlet on the subject, which has been translated by Admiral Fitzroy, of the Board of Trade. From this important document it appears that Herrings seek that part of the sea in which the temperature is not less than 54° Fahr., nor more than 58° Fahr.

THE OLD HALL OF THE FISHMONGERS OF LONDON.

Si benè qui cœnat, benè vivit: lucet, eamus.
Quo ducit gula, piscemur. . . . . .
Hor., Epist. i. vi. 56.

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WHEEL AND SPINDLE, ST. ANDREWS.

"Prima diœcesis et antiquissima regni
Patroni Andreæ nobile nomen habet."
(*Carmen de Fifa*, Sibbald.)

"St. Rule, a monk of Patræ, in Achaia, warned by a vision, A.D. 370, is said to have sailed westward till he landed at St. Andrew's, where he founded a chapel and tower."—Scott, *Marmion*, i. *notes*.

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